Refrigeration Service Engineer

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AIR CONDITIONING • GAUGE HANDS •
LIFTER • QUESTIONS AND ANSWERS •
HEATING AND AIR CONDITIONING •

"Easy to install!"

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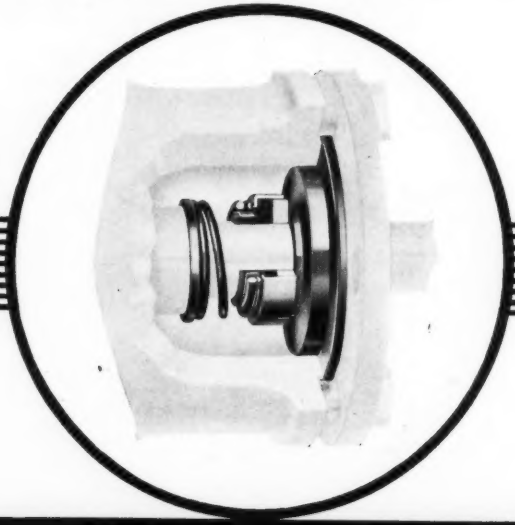

ROTARY SEAL COMPANY

805 W. MADISON STREET, CHICAGO, ILL.

Rotary Seal Replacement Units are fully covered by U. S. and foreign patents.

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"We find Automatic Products products are meeting with a great deal of popularity, and when installed on jobs, are doing perfect work."

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President

Clarence F. (Sandy) Pratt
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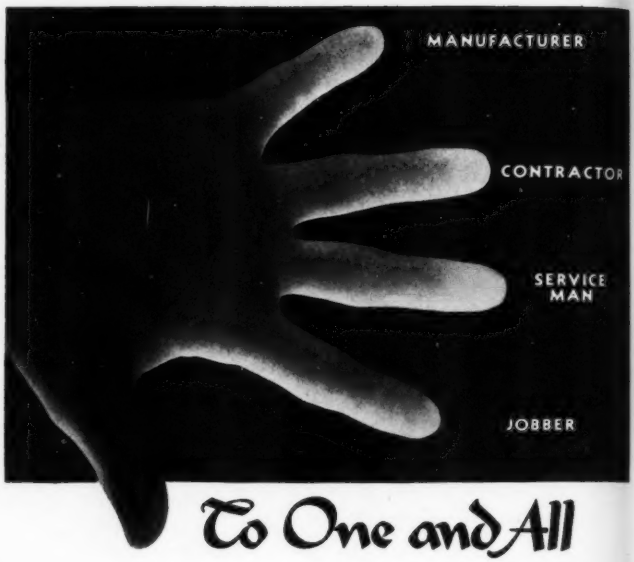

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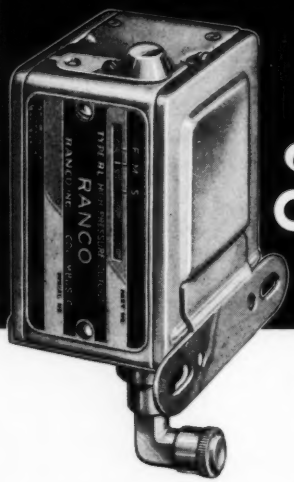

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The Refrigeration Service Engineer

Vol. 5 No. 12

December, 1937

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

COVER

This month's cover shows the Electrolux unit in the process of manufacture. The entire system is made of steel, with all joints strongly welded together. The picture originally appeared in the publication, "Oxy-Acetylene Tips" and is reproduced here through permission of the Linde Air Products Co.

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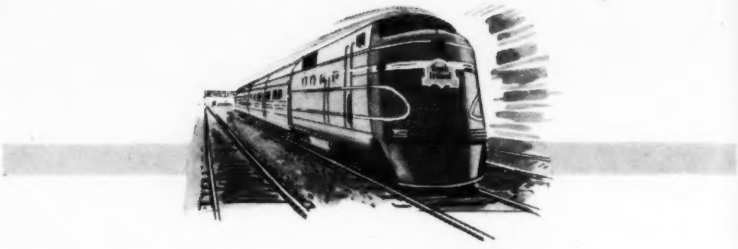

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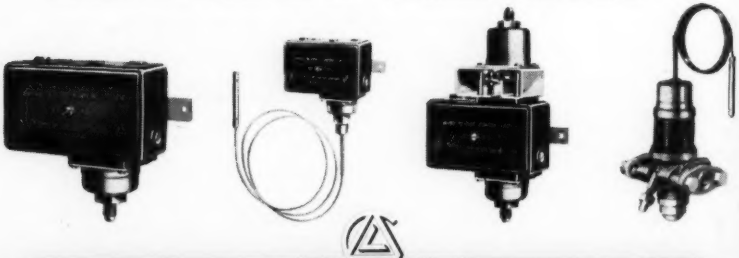

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Sixth Article

Air Conditioning

Proper Size Refrigerant Lines

By W. C. FARMINGDALE

THE capacity of any refrigerant depends upon the back pressure (suction temperature) at which the machine operates. As the back pressure goes down, the capacity of the refrigerating machine goes down. This fact can easily be verified by examining any manufacturer's specification sheets.

As an example, from Universal Cooler catalogue, a five horsepower Universal machine has a capacity of 62,000 B.t.u.'s per hour when operated at 37 pounds (40 degree F.) back pressure.

At 21 pounds (20 degrees F.) back pressure, the capacity of this machine drops to 42,000 B.t.u.'s per hour or a capacity drop of 20,000 B.t.u.'s, because of a back pressure drop of 16 pounds.

From this example, it can readily be seen it is extremely important the refrigerating machine operates at the proper back pressure in order to get the rated capacity of our cooling system. Because of competition, estimators often figure jobs close to rated capacity in order to reduce the price of the system. Unless the installation department is on its toes the system is sure to fall short of expectations because of a lack of capacity, caused by too low an operating suction pressure.

Before we discuss why many jobs which are properly engineered provide insufficient cooling, let us first consider the condition known among air conditioning engineers as "balancing out."

Balancing Out

When an engineer specifies a cooling coil for a unit, he invariably intends that the entire surface of the coil be used to absorb heat. The amount of heat the cooling coil will absorb will be determined by several factors among which are:

1. Area of the cooling coil.
2. Temperature of the cooling coil.
3. Wet and dry bulb temperatures of air passing over the coil.
4. Amount (c.f.m.) of air passing over the coil per minute.

If the entire coil surface is used to absorb heat, for a given wet and dry bulb temperature and a fixed amount of air passing over the coil, the amount of heat absorbed per minute will depend upon the temperature of the cooling coil.

On a coil equipped with a thermostatic expansion valve, the temperature of the cooling coil will be determined directly by the size of the refrigerating machine connected

to it. For instance, if a ½ hp. refrigerating machine is connected to the cooling coil, the cooling coil may absorb 6,000 B.t.u.'s and the temperature of the refrigerant may be 40 degrees F. If a ¾ hp. refrigerating machine is connected to the same cooling coil, the coil may absorb 7,000 B.t.u.'s, but the temperature of the refrigerant will be 35 degrees F. Then, too, if a 1 hp. refrigerating machine were connected to the cooling coil under the same operating conditions the cooling coil might absorb 8,000 B.t.u.'s but the refrigerant temperature would have dropped to 30 degrees F.

Thus the temperature at which the cooling coil operates and the amount of heat absorbed depends upon the size refrigerating machine which is connected to the coil under definite load conditions.

Briefly, this means that as a larger size machine is connected to a cooling coil, the temperature of the refrigerant is lowered, but as the *refrigerant temperature is lowered, the capacity of the refrigerating machine is lowered.* Hence, whenever a cooling coil and a refrigerating machine are connected together, the capacity of the cooling coil will "balance out" the capacity of the refrigerating machine at a suction temperature at which the coil is absorbing as many B.t.u.'s as the refrigerating machine can dispose of. This condition is known as "balancing out" and the temperature at which it occurs is called the "balancing out temperature."

Pressure Drop in Suction Lines

In order to get rated capacity out of a cooling system, the balancing out temperature must be the same at the cooling coil as at the refrigerating machine. This condition will not come about unless the installation department carefully lays out the system's refrigerant lines and especially the suction line.

We know that if a long garden hose is connected to a water line, water will come out of the hose slowly and with little force. Yet if the hose is disconnected from the water pipe, the water will flow out of the pipe rapidly and with considerable force. What happened to the water as it flowed through the hose is apparent. The water continually striking against the sides of the hose caused a loss in pressure which slowed up the flow of water through the hose.

If a length of pipe instead of a length of hose had been connected to the water line, the water would have lost its pressure just as it did when it flowed through the hose.

The point we want to bring out is, in order to maintain the flow of a fluid through a pipe, the size of the pipe will be determined by two factors:

1. Amount of fluid to pass through the pipe.
2. The maximum amount of pressure-loss permissible in the pipe.

If a plumber had to run a water main into a house 20 feet from the city mains, he would use a certain size pipe. If he had to run a water main into the house at a distance of 100 feet from the city water main, he would probably use a pipe about three sizes larger than that in the foregoing example.

The same reasoning applies to the sizing of refrigerant piping. If too small a suction line is provided, there will be considerable pressure drop between the cooling coil and the compressor. As we learned above, the capacity of the refrigerating machine is seriously affected by the back pressure at which it operates. If there is a large pressure drop in the suction line, the refrigerating machine will not remove heat from the cooling coil as fast as the design engineer intended it to. As a result, the balancing out temperature will be higher than was intended and the system will not provide the proper amount of cooling.

Effect of Suction Lines Too Large

For the most part in commercial refrigeration, the suction lines cannot be too large. That is to say, an oversize suction line will not affect the operation of the cooling system. (Of course, it will raise the initial cost of the system considerably.) Invariably in commercial refrigeration, the cooling coil is higher than the refrigerating machine so that oil (which always circulates with the refrigerant) can drain back to the refrigerating machine by gravity.

In air conditioning systems, however, the refrigerating machines are often higher than the cooling coils. Then, too, refrigerant lines must often be carried over doorways, so that oil cannot drain back to the refrigerating machine.

This is of great importance because if oil continues to flow out of the compressor into the system, eventually the compressor will run dry and stick-up. This will result in high service costs and a dissatisfied customer.

Oil that has circulated with the refrigerant will tend to settle out of the refrigerant gas as it passes through the suction line to

the compressor. If the suction line is over size, this oil will lie in the bottom of the line and never return to the compressor.

If the suction line is of the proper size, the gas passing through the suction line will travel at such a fast rate of speed over the oil that it will scrub up the oil and carry it back to the compressor where it belongs. (This scrubbing effect can be illustrated by blowing air under pressure over an open pan of water.)

Hence, on air conditioning installations, the suction line must be of the correct size to insure proper operation of the cooling system.

If the line is too small, there will be a large pressure drop in the suction line which will reduce the capacity of the system materially.

If, on the other hand, the suction line is too large, oil will collect in the suction line and the compressor wil run dry and either stick-up or badly scorch its cylinders and ruin its bearings.

Effect of Liquid Line Sizes

The proper size liquid lines must be used to insure a sufficient supply of liquid to the cooling coil. As in the case of the hose connected to a water line, if the liquid line is long and is too small in size, very little liquid will flow into the cooling coil each minute. As a result, the cooling coil will starve and the capacity of the system will be lessened.

If too large a liquid line is used, the system will operate satisfactorily, but the liquid line will have to contain more refrigerant than is necessary to produce the desired cooling effect. The liquid line must at all times be filled with liquid refrigerant. If the liquid line is oversized, refrigerant must be added to the system until the oversize liquid line is completely filled. Thus an oversize line makes the initial cost of the installation high for two reasons:

1. Extra cost of labor and tubing.
2. Cost of excess refrigerant required.

Need for Proper Information on Refrigerant Line Sizes

Up until the present time, no concise table has been available for use by the average installation man. Many tables and charts for the guidance of the installation man have been published but they have been arranged in such a form that laborious calculations had to be made before the proper size of lines could be determined. Then, too, most of these tables and charts gave their information for 100-foot runs only, and so on shorter runs, or longer runs, the installation man had to make many hazardous guesses.

Accordingly, the following tables have been prepared to give the required information in a concise, complete form. The sizes of lines required can be quickly picked from these tables without any involved calculations.

The suction line table is based on a maximum pressure drop of 2 pounds between the suction side of the cooling coil and the compressor suction valve with a 1,000-foot per minute velocity in the suction main which insures proper oil return under normal installation conditions. The following instructions for using the table describe how abnormal conditions may be overcome.

How to Use Table I

Since Table I has been based on a pressure drop between the furthermost unit

TABLE I. CAPACITY OF F12 SUCTION LINES FOR AIR CONDITIONING.

Refrigerant Temperature 40 Degrees F.; Total Pressure Drop 2 Pounds; Gas Velocity 1,000 Feet per Minute. Average Number of Fittings.

Distance in Feet Between Refrigerating Machine and Cooling Coil.	Outside Diameter of Copper Pipe.					
	5/8"	7/8"	1 1/8"	1 3/8"	1 5/8"	2 1/8"
	B.t.u. Capacity per Hour.					
20	11,000	25,000	50,000	85,000	120,000	
40	8,800	20,000	40,000	70,000	105,000	
60	7,500	17,000	35,000	60,000	100,000	
80	6,200	13,000	30,000	50,000	78,000	
100	5,000	12,000	25,000	43,000	68,000	130,000
120	4,500	10,500	22,500	38,000	60,000	115,000
140	3,750	10,000	20,000	34,000	55,000	100,000

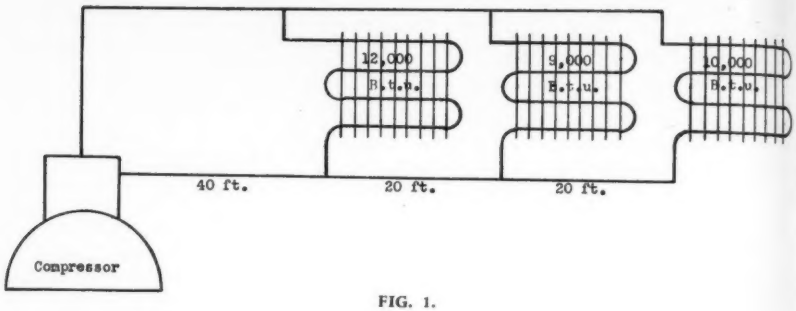


FIG. 1.

and the refrigerating machine of 2 pounds, in using the table, *all sections of a suction main in one branch must be selected from the line in Table I corresponding to the maximum distance between any cooling coil in that branch and the refrigerating machine.* If this is not done, and if the values selected from Table I are for the individual lengths of tubing between cooling coils, a pressure drop considerably more than 2 pounds will exist between the furthermost cooling coil and the refrigerating machine.

To make this clear, let us consider several types of layouts. First let us take the simple system laid out as in Figure 1.

The distance between the furthermost cooling coil and the refrigerating machine is 80 feet. Hence, all sizes of the suction line will be chosen from the 80-foot line in Table I.

We will size our suction starting at the refrigerating machine and working toward the furthermost cooling coil. The first 40 feet of our suction line must carry the entire cooling load which is 12,000 B.t.u. plus 9,000 B.t.u. plus 10,000 B.t.u. or a total of 31,000 B.t.u.

From the 80 foot line in Table I, we see that 1⅛-inch pipe will carry 30,000 B.t.u., so, for this first section we will select 1⅛-inch copper pipe.

Now we'll proceed to the next 20 foot section. This section of the suction line will carry 9,000 B.t.u. plus 10,000 B.t.u. or 19,000 B.t.u. From the 80-foot line in Table I, we find that a ⅞-inch tube will carry only 13,500 B.t.u. Hence, a 1⅛-inch pipe must be used for this run.

The last 20-foot section of the suction line will carry only 10,000 B.t.u. From the 80-foot line in Table I, we find that ⅝-inch tubing will carry 7,500 B.t.u. Ordinarily this would be a little too small, but since we had such an excess capacity on our other 20-foot run, we can safely use ⅝-inch tubing for our last section.

In another article we will consider more complicated circuits made up of several branches and also those cases where suction lines must be run over doorways.

* * *

Heating and Air Conditioning

Chapter-3 Continued

By H. D. BUSBY

ON the following pages appear more of the tables on conductivities of materials, and the coefficients of transmission for various walls found in building construction.

The first part of Table 2 appeared in the November issue. On the following page is the completion of Table 2 and the complete Tables 3, 4 and 5. Tables 6 to 13, inclusive, covering the same data on other types of construction, will appear in the January issue.

Coefficients for composite walls are expressed in B.t.u. per hour per square foot per degree Fahrenheit difference in temperature between the air on the two sides, and are based on a wind velocity of 15 miles per hour.

TABLE 2. CONDUCTIVITIES (k) AND CONDUCTANCES (C) OF BUILDING MATERIALS AND INSULATORS—Continued

The coefficients are expressed in Btu per hour per square foot per degree Fahrenheit per 1 in. thickness, unless otherwise indicated

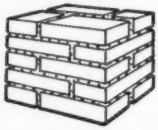
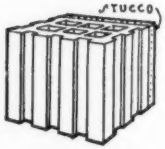
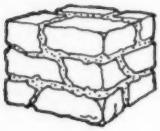
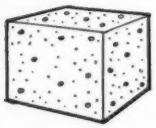
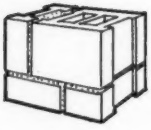
Material	Description	Density (Lb per Cu Ft)	Mean Temp. (Deg Fahr)	Conductivity (k) or Conductance (C)	Resistivity $\left(\frac{1}{k}\right)$ or Resistance $\left(\frac{1}{C}\right)$	Authority [4]
WOODS—Continued						
Longleaf Yellow Pine	0% moisture	30.0	75	0.76	1.32	(4)
	0% "	40.0	75	0.86	1.16	(4)
	8% "	30.0	75	0.83	1.21	(4)
	8% "	40.0	75	0.95	1.05	(4)
	16% "	30.0	75	0.89	1.12	(4)
	16% "	40.0	75	1.03	0.97	(4)
Mahogany		34.3	86	0.90	1.11	(1)
Maple		44.3	86	1.10	0.91	(1)
Maple or Oak		.....	...	1.15*	0.87	...
Norway Pine	0% moisture	22.0	75	0.62	1.61	(4)
	0% "	32.0	75	0.74	1.35	(4)
	8% "	22.0	75	0.68	1.47	(4)
	8% "	32.0	75	0.83	1.21	(4)
	16% "	22.0	75	0.74	1.35	(4)
	16% "	32.0	75	0.91	1.10	(4)
Red Cypress	0% moisture	22.0	75	0.67	1.49	(4)
	0% "	32.0	75	0.79	1.27	(4)
	8% "	22.0	75	0.71	1.41	(4)
	8% "	32.0	75	0.84	1.19	(4)
	16% "	22.0	75	0.74	1.35	(4)
	16% "	32.0	75	0.90	1.11	(4)
Red Oak	0% moisture	38.0	75	0.98	1.02	(4)
	0% "	48.0	75	1.18	0.85	(4)
	8% "	38.0	75	1.03	0.97	(4)
	8% "	48.0	75	1.24	0.81	(4)
	16% "	38.0	75	1.07	0.94	(4)
	16% "	48.0	75	1.29	0.78	(4)
Shortleaf Yellow Pine	0% moisture	26.0	75	0.74	1.35	(4)
	0% "	36.0	75	0.91	1.10	(4)
	8% "	26.0	75	0.79	1.27	(4)
	8% "	36.0	75	0.97	1.03	(4)
	16% "	26.0	75	0.84	1.19	(4)
	16% "	36.0	75	1.04	0.96	(4)
Soft Elm	0% moisture	28.0	75	0.73	1.37	(4)
	0% "	34.0	75	0.88	1.14	(4)
	8% "	28.0	75	0.77	1.30	(4)
	8% "	34.0	75	0.93	1.08	(4)
	16% "	28.0	75	0.81	1.24	(4)
	16% "	34.0	75	0.97	1.03	(4)
Soft Maple	0% moisture	36.0	75	0.89	1.12	(4)
	0% "	42.0	75	0.95	1.05	(4)
	8% "	36.0	75	0.96	1.04	(4)
	8% "	42.0	75	1.02	0.98	(4)
	16% "	36.0	75	1.01	0.99	(4)
	16% "	42.0	75	1.09	0.92	(4)
Sugar Pine	0% moisture	22.0	75	0.54	1.85	(4)
	0% "	28.0	75	0.64	1.56	(4)
	8% "	22.0	75	0.59	1.70	(4)
	8% "	28.0	75	0.71	1.41	(4)
	16% "	22.0	75	0.65	1.54	(4)
	16% "	28.0	75	0.78	1.28	(4)
Virginia Pine		34.3	86	0.96	1.04	(1)
West Coast Hemlock	0% moisture	22.0	75	0.68	1.47	(4)
	0% "	30.0	75	0.79	1.27	(4)
	8% "	22.0	75	0.73	1.37	(4)
	8% "	30.0	75	0.85	1.18	(4)
	16% "	22.0	75	0.78	1.28	(4)
	16% "	30.0	75	0.91	1.10	(4)
White Pine		31.2	86	0.78	1.28	(1)
Yellow Pine		.....	...	1.00	1.00	(3)
Yellow Pine or Fir		.....	...	0.80*	1.25	...

For notes, see first page of Table 2, November issue.

Copyright, American Society of Heating and Ventilating Engineers—From A.S.H.V.E. Guide, 1937.

TABLE 3. COEFFICIENTS OF TRANSMISSION (U) OF MASONRY WALLS[a]

Coefficients are expressed in Btu per hour per square foot per degree Fahrenheit difference in temperature between the air on the two sides, and are based on a wind velocity of 15 mph.

TYPICAL CONSTRUCTION	TYPE OF WALL	THICKNESS OF MASONRY (INCHES)	WALL NO.
	**Solid Brick** Based on 4-in. hard brick and the remainder common brick.	8 12 16	1 2 3
	**Hollow Tile** Stucco Exterior Finish. The 8-in. and 10-in. tile figures are based on two cells in the direction of flow of heat. The 12-in. tile is based on three cells in the direction of flow of heat. The 16-in. tile consists of one 10-in. tile and one 6-in. tile each having two cells in the direction of heat flow.	8 10 12 16	4 5 6 7
	**Limestone or Sandstone**	8 12 16 24	8 9 10 11
	**Concrete (Monolithic)** These figures may be used with sufficient accuracy for concrete walls with stucco exterior finish.	6 10 16 20	12 13 14 15
	Cinder (Monolithic) Conductivity $k = 4.36$	6 10 16 20	16 17 18 19
	Haydite (Monolithic) Conductivity $k = 3.96$	6 10 16 20	20 21 22 23
	**Cinder Blocks** Cores filled with dry cinders, 69.7 lb per cu ft. Cores filled with granulated cork, 5.12 lb per cu ft. Cores filled with rock wool, 14.2 lb per cu ft. Based on one air cell in direction of heat flow. Cores filled with granulated cork, 5.24 lb per cu ft.	8 8 8 8 12 12	24 25 26 27 28 29
	Concrete Blocks Cores filled with granulated cork, 5.14 lb per cu ft. Based on one air cell in direction of heat flow.	8 8 12	30 31 32
	Haydite Blocks Cores filled with granulated cork, 5.06 lb per cu ft.	8 8	33 34
	Haydite Blocks Cores filled with granulated cork, 5.6 lb per cu ft.	12 12	35 36

[a] Computed from factors marked by * in Table 2.

[b] Based on the actual thickness of 2-in. furring strips.

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Wall No.	Uninsulated Walls						Insulated Walls					
	Plain walls—no interior finish	Plaster (½ in.) on walls	Plaster on wood lath—furred	Plaster (¾ in.) on metal lath—furred	Plaster (½ in.) on plaster board (⅜ in.)—furred	Decorated building board (½ in.) without plaster—furred	Plaster (½ in.) on rigid insulation (½ in.)—furred	Plaster (½ in.) on rigid insulation (1 in.)—furred	Plaster (½ in.) on corkboard (1½ in.) set in cement mortar (½ in.)	Plaster (¾ in.) on metal lath attached to furring strips—furred space (over ¾-in. wide) faced one side with bright aluminum foil	Plaster on metal lath attached to furring strips (2 in.[b])—rock wool fill (1⅝ in.[b])[c]	Plaster (¾ in.) on metal lath attached to furring strips (2 in.[b])—flexible insulation (½ in.) between furring strips (one air space)
	A	B	C	D	E	F	G	H	I	J	K	L
1	0.50	0.46	0.30	0.32	0.30	0.23	0.22	0.16	0.14	0.23	0.12	0.20
2	0.36	0.34	0.24	0.25	0.24	0.19	0.19	0.14	0.12	0.19	0.11	0.17
3	0.28	0.27	0.20	0.21	0.20	0.17	0.16	0.13	0.11	0.17	0.10	0.15
4	0.40	0.37	0.26	0.27	0.26	0.20	0.20	0.15	0.13	0.20	0.11	0.18
5	0.39	0.37	0.26	9.27	0.26	0.20	0.19	0.15	0.13	0.20	0.11	0.18
6	0.30	0.29	0.22	0.22	0.22	0.17	0.17	0.13	0.12	0.17	0.10	0.16
7	0.25	0.24	0.19	0.19	0.19	0.15	0.15	0.12	0.11	0.15	0.097	0.14
8	0.71	0.64	0.37	0.39	0.37	0.26	0.25	0.18	0.15	0.26	0.13	0.23
9	0.58	0.53	0.33	0.34	0.33	0.24	0.23	0.17	0.14	0.24	0.13	0.21
10	0.49	0.45	0.30	0.31	0.30	0.22	0.22	0.16	0.14	0.22	0.12	0.20
11	0.37	0.35	0.25	0.26	0.25	0.20	0.19	0.15	0.13	0.20	0.11	0.18
12	0.79	0.70	0.39	0.42	0.39	0.27	0.26	0.19	0.16	0.27	0.13	0.23
13	0.62	0.57	0.34	0.37	0.34	0.25	0.24	0.18	0.15	0.25	0.13	0.22
14	0.48	0.44	0.29	0.31	0.29	0.22	0.21	0.16	0.14	0.22	0.12	0.20
15	0.41	0.39	0.27	0.28	0.27	0.21	0.20	0.15	0.13	0.21	0.12	0.18
16	0.46	0.43	0.29	0.30	0.29	0.22	0.21	0.16	0.14	0.22	0.12	0.19
17	0.33	0.31	0.23	0.24	0.23	0.18	0.18	0.14	0.12	0.18	0.11	0.16
18	0.22	0.22	0.17	0.18	0.17	0.15	0.14	0.12	0.10	0.15	0.09	0.13
19	0.19	0.18	0.15	0.15	0.15	0.13	0.13	0.11	0.09	0.13	0.09	0.12
20	0.44	0.41	0.28	0.29	0.28	0.21	0.21	0.16	0.13	0.21	0.12	0.19
21	0.30	0.29	0.22	0.23	0.22	0.17	0.17	0.14	0.12	0.18	0.10	0.16
22	0.21	0.20	0.16	0.17	0.16	0.14	0.14	0.11	0.10	0.14	0.09	0.13
23	0.17	0.17	0.14	0.14	0.14	0.12	0.12	0.10	0.09	0.12	0.08	0.11
24	0.42	0.39	0.27	0.28	0.27	0.21	0.20	0.16	0.13	0.21	0.12	0.19
25	0.31	0.29	0.23	0.23	0.22	0.18	0.17	0.14	0.12	0.18	0.11	0.16
26	0.22	0.21	0.17	0.18	0.17	0.14	0.14	0.12	0.11	0.14	0.09	0.13
27	0.23	0.22	0.19	0.18	0.18	0.15	0.14	0.12	0.10	0.15	0.09	0.14
28	0.37	0.35	0.25	0.26	0.25	0.19	0.19	0.15	0.13	0.19	0.11	0.17
29	0.20	0.19	0.17	0.16	0.16	0.13	0.13	0.11	0.10	0.14	0.09	0.13
30	0.56	0.52	0.32	0.34	0.32	0.24	0.23	0.17	0.14	0.24	0.12	0.21
31	0.41	0.39	0.27	0.28	0.27	0.21	0.20	0.15	0.13	0.21	0.12	0.18
32	0.49	0.46	0.30	0.32	0.30	0.23	0.22	0.16	0.14	0.23	0.12	0.20
33	0.36	0.34	0.26	0.26	0.24	0.19	0.19	0.15	0.13	0.19	0.11	0.17
34	0.18	0.17	0.15	0.15	0.14	0.13	0.12	0.10	0.09	0.13	0.08	0.12
35	0.34	0.32	0.25	0.25	0.24	0.19	0.18	0.14	0.12	0.19	0.11	0.17
36	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.09	0.08	0.11	0.08	0.10

[a] A waterproof membrane should be provided between the outer material and the insulation fill to prevent possible wetting by absorption and a subsequent lowering of efficiency.

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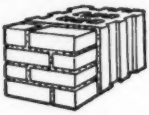
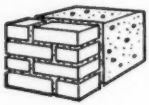
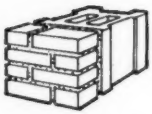
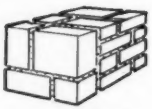
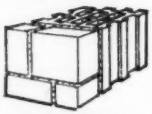
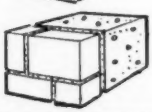
Table 4. Coefficients of Transmission (U) of Masonry Walls with Various Types of Veneers[a]

Coefficients are expressed in Btu per hour per square foot per degree Fahrenheit difference in temperature between the air on the two sides, and are based on a wind velocity of 15 mph.

Typical Construction	Type of Wall		Wall No.
	Facing	Backing	
	4 in. **Brick Veneer**[d]	6 in. 8 in. **Hollow Tile**[c] 10 in. 12 in.	37 38 39 40
	4 in. **Brick Veneer**[d]	6 in. 10 in. **Concrete** 16 in.	41 42 43
	4 in. **Brick Veneer**[d]	8 in. **Cinder Blocks** 8 in. **Cinder Blocks** — Cores filled with granulated cork, 5.12 lb per cu ft. 12 in. **Cinder Blocks** 12 in. **Cinder Blocks** — Cores filled with granulated cork, 5.24 lb per cu ft.	44 45 46 47
		8 in. **Concrete Blocks** 8 in. **Concrete Blocks**—Cores filled with granulated cork, 5.14 lb per cu ft. 12 in. **Concrete Blocks** 8 in. **Haydite Block** 8 in. **Haydite Block**—Cores filled with granulated cork, 5.06 lb per cu ft. 12 in. **Haydite Block** 12 in. **Haydite Block**—Cores filled with granulated cork, 5.6 per cu ft.	48 49 50 51 52 53 54
	4 in. **Cut-Stone Veneer**[d]	8 in. 12 in. **Common Brick** 16 in.	55 56 57
	4 in. **Cut-Stone Veneer**[d]	6 in. 8 in. 10 in. **Hollow Tile** 12 in.	58 59 60 61
	4 in. **Cut-Stone Veneer**[d]	6 in. 10 in. **Concrete** 16 in.	62 63 64

[a] Computed from factors marked by * in Table 2.
[b] Based on the actual thickness of 2-in. furring strips.
[c] The 6-in., 8-in. and 10-in. tile figures are based on two cells in the direction of heat flow. The 12-in tile is based on three cells in the direction of heat flow.

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Uninsulated Walls						Insulated Walls					
Plain wall—no interior finish	Plaster (½ in.) on walls	Plaster on wood lath—furred	Plaster (⅜ in.) on metal lath—furred	Plaster (½ in.) on plaster board (⅜ in.)—furred	No plaster—decorated rigid or building board interior finish (½ in.)—furred	Plaster (½ in. on rigid insulation (½ in.)—furred	Plaster (½ in.) on rigid insulation (1 in.)—furred	Plaster on cork board (1½ in.) set in cement mortar (½ in.)	Plaster on metal lath (¾ in.) attached to furring strips—furred space (over ¾-in. wide) faced one side with bright aluminum foil	Plaster (¾ in.) on metal lath attached to furring strips (2 in.[b])—rock wool fill (1⅝ in.[b])[f]	Plaster (¾ in.) on metal lath attached to furring strips (2 in.[b])—flexible insulation (1⅝ in.) between furring strips (one air space)
A	B	C	D	E	F	G	H	I	J	K	L
0.36	0.34	0.24	0.25	0.24	0.19	0.19	0.16	0.13	0.19	0.11	0.17
0.34	0.33	0.24	0.25	0.24	0.19	0.18	0.14	0.12	0.19	0.11	0.17
0.34	0.32	0.23	0.24	0.23	0.19	0.18	0.14	0.12	0.19	0.11	0.17
0.27	0.26	0.20	0.21	0.20	0.16	0.16	0.13	0.11	0.16	0.10	0.15
0.57	0.53	0.33	0.35	0.33	0.24	0.23	0.17	0.14	0.24	0.13	0.21
0.48	0.45	0.30	0.31	0.30	0.22	0.22	0.16	0.14	0.22	0.12	0.20
0.39	0.37	0.26	0.27	0.26	0.20	0.19	0.15	0.13	0.20	0 11	0.18
0.35	0.33	0.24	0.25	0.24	0.19	0.18	0.14	0.12	0.19	0.11	0.17
0.20	0.19	0.16	0.16	0.16	0.13	0.13	0.11	0.10	0.13	0.09	0.12
0.31	0.30	0.22	0.23	0.22	0.18	0.17	0.14	0.12	0.18	0.11	0.16
0.18	0.18	0.15	0.15	0.15	0.13	0.12	0.10	0.09	0.13	0.08	0.12
0.44	0.42	0.28	0.30	0.28	0.21	0.21	0.16	0.13	0.21	0.12	0.19
0.34	0.32	0.24	0.25	0.23	0.19	0.18	0.14	0.12	0.19	0.11	0.17
0.40	0.38	0.26	0.28	0.26	0.20	0.20	0.15	0.13	0.20	0.11	0.18
0.31	0.29	0.23	0.23	0.22	0.18	0.17	0.14	0.12	0.18	0.11	0.16
0.17	0.16	0.14	0.14	0.14	0.12	0.12	0.10	0.09	0.12	0.08	0.11
0.29	0.28	0.21	0.22	0.21	0.17	0.17	0.13	0.12	0.17	0.10	0.16
0.14	0.14	0.12	0.12	0.12	0.10	0.10	0.09	0.08	0.10	0.07	0.10
0.37	0.35	0.25	0.26	0.25	0.19	0.19	0.15	0.13	0.19	0.11	0.17
0.28	0.27	0.21	0.21	0.21	0.17	0.16	0.13	0.12	0.17	0.10	0.15
0.23	0.22	0.18	0.18	0.18	0.15	0.14	0.12	0.11	0.15	0.095	0.14
0.37	0.35	0.25	0.26	0.25	0.20	0.19	0.15	0.13	0.20	0.11	0.18
0.36	0.34	0.24	0.25	0.24	0.19	0.19	0.15	0.13	0.19	0.11	0.17
0.35	0.33	0.24	0.25	0.24	0.19	0.18	0.14	0.12	0.19	0.11	0.17
0.28	0.26	0.20	0.21	0.20	0.17	0.16	0.13	0.11	0.17	0.10	0.15
0.61	0.56	0.34	0.36	0.34	0.25	0.24	0.18	0.15	0.25	0.13	0.22
0.51	0.47	0.31	0.32	0.31	0.23	0.22	0.17	0.14	0.23	0.12	0.20
0.41	0.38	0.26	0.28	0.26	0.20	0.20	0.15	0.13	0.21	0.11	0.18

[d]Calculations include cement mortar (½ in.) between veneer or facing and backing.
[b]Based on one air cell in direction of heat flow.
[f]A waterproof membrane should be provided between the outer material and the insulation fill to prevent possible wetting by absorption and a subsequent lowering of efficiency.

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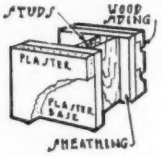
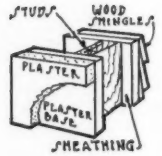
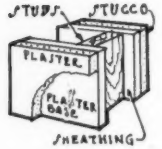
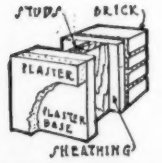
TABLE 5. COEFFICIENTS OF TRANSMISSION (U) OF VARIOUS TYPES OF FRAME CONSTRUCTION[a]

These coefficients are expressed in Btu per hour per square foot per degree Fahrenheit difference in temperature between the air on the two sides, and are based on a wind velocity of 15 mph.

TYPICAL CONSTRUCTION	EXTERIOR FINISH	TYPE OF SHEATHING	WALL No.
	**Wood Siding or Clapboard**	1 in. **Wood**[d]	65
		½ in. **Rigid Insulation**	66
		½ in. **Plaster Board**	67
	**Wood Shingles**	1 in. **Wood**[d]	68
		½ in. **Rigid Insulation**[e]	69
		½ in. **Plaster Board**[c]	70
	**Stucco**	1 in **Wood**[d]	71
		½ in. **Rigid Insulation**	72
		½ in. **Plaster Board**	73
	**Brick/ Veneer**	1 in. **Wood**[d]	74
		½ in. **Rigid Insulation**	75
		½ in. **Plaster Board**	76

[a]Computed from factors marked by * in Table 2.

[b]These coefficients may also be used with sufficient accuracy for plaster on wood lath or plaster on plaster board.

[d]Based on the actual width of 2 by 4-in. studding, namely, 3⅝ in.

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No Insulation Between Studding							Insulation Between Studding		
Plaster on wood lath on studding	Plaster (¾ in.) on metal lath on studding	Plaster (½ in.) on plaster board (¾ in.) on studding	Plaster (½ in.) on rigid insulation (½ in.) on studding	Plaster (½ in.) on rigid insulation (1 in.) on studding	Plaster (½ in.) on corkboard (1½ in.) on studding	No plaster—decorated rigid or building board interior finish (½ in.)	Plaster (¾ in.) on metal lath—stud space faced one side with bright aluminum foil	Plaster (¾ in.) on metal lath[b] on studding—rock wool fill (3½ in.[c]) between studding[g]	Plaster (¾ in.) on metal lath[b] on studding—flexible insulation (½ in.) between studding and in contact with sheathing
A	B	C	D	E	F	G	H	I	J
0.25	0.26	0.25	0.19	0.15	0.11	0.19	0.20	0.072	0.17
0.23	0.24	0.23	0.18	0.14	0.11	0.18	0.19	0.070	0.17
0.31	0.33	0.31	0.22	0.17	0.13	0.23	0.24	0.076	0.20
0.25	0.26	0.25	0.19	0.15	0.11	0.19	0.20	0.072	0.17
0.19	0.20	0.19	0.15	0.12	0.10	0.16	0.16	0.066	0.14
0.24	0.25	0.24	0.19	0.15	0.11	0.19	0.19	0.071	0.17
0.30	0.31	0.30	0.22	0.16	0.12	0.22	0.23	0.076	0.20
0.27	0.29	0.27	0.20	0.16	0.12	0.21	0.22	0.074	0.19
0.40	0.43	0.40	0.26	0.19	0.14	0.28	0.29	0.081	0.24
0.27	0.28	0.27	0.20	0.15	0.12	0.21	0.21	0.074	0.18
0.25	0.26	0.25	0.19	0.15	0.11	0.19	0.20	0.072	0.18
0.35	0.37	0.35	0.24	0.18	0.13	0.25	0.26	0.079	0.22

[d]Yellow pine or fir—actual thickness about 25/32 in.

[e]Furring strips between wood shingles and sheathing.

[f]Small air space and mortar between building paper and brick veneer neglected.

[g]A waterproof membrane should be provided between the outer material and the insulation fill to prevent possible wetting by absorption and a subsequent lowering of efficiency.

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Velocities in Suction Mains and Evaporators

Fifth Article—Concluded

Size of Suction Mains for Various Refrigerants

By J. O. SCHULTZ*

THE four tables previously referred to, appearing in the August to November issues, giving the velocities in suction mains and evaporators, will enable the designer to select the number of evaporators.

Tables V, VI, VII and VIII will eliminate the long tedious calculations in the selection of the proper size suction mains for use with the various refrigerants on large and small systems.

Example

In the following paragraphs an identical example for three of the refrigerants will be worked out so that comparisons can be made, using the tables to select the number of coils together with their connections and small systems.

For Methyl Chloride, CH_3Cl.

A small market has two refrigerators, the refrigerating load on one being 2,000 B.t.u. per hour and 7000 B.t.u. per hour on the other; the refrigerant being methyl chloride and the plant is to operate with 20 degrees F. suction gas; the smaller refrigerator being farthest removed from the compressor.

Referring to Table II, September issue, we find that the smaller refrigerator can be cooled with one evaporator if 5/8-inch diameter tube is used for the coil, as this size tube in one continuous coil can convey the gases generated at 20 degrees F. for a refrigerating load of 2742 B.t.u. per hour; if 1/2-inch tube evaporator is used it will require two coils, as this size tube can only carry the gases for a refrigerating load of 1446 B.t.u. per hour and still maintain the proper coil outlet velocity.

For the larger refrigerator two evaporators of 3/4-inch tubes are to be used, as each has a carrying capacity of 3949 B.t.u. per hour; if 5/8-inch tube evaporator is to be used it will require three coils. The suction mains can be determined from accompanying Table VI.

The smaller refrigerator with one evaporator would have a suction main of 3/8-inch tube and each of the two evaporators in the larger refrigerator would also have 3/8-inch tube size suction main. Assuming that no suction main from any of the coils exceeds 25 feet in length the 3/8-inch size tube is correct.

The 3/8-inch suction main from smaller refrigerator is to be increased to 1/2-inch tube where the first of the two large refrigerator coils enter, as the refrigerating load at this point is 5500 B.t.u. per hour, and is further to be increased to 5/8-inch tube where last coil connects into the main.

Where manifold system is used, the suction from each is 3/8-inch tube into the manifold and 5/8-inch tube is run from manifold to the compressor.

For Ammonia, NH_3.

Refer to Table I., August issue. An evaporator of 3/4-inch extra heavy pipe size will carry a greater load than either the small or large refrigerator develops; this size can be used in single coils for each refrigerator. Where a single feed system is used it would be permissible to use 3/4-inch pipe evaporator with a 3/4-inch pipe connecting the two evaporators, as the total load is 9000 B.t.u. per hour. The carrying capacity of 3/4-inch pipe evaporator at 20 degrees F. suction temperature is 11,772 B.t.u. per hour. Reference to Table V. will permit selection of proper suction mains.

If separate feeds are used these should be 1/2-inch extra heavy pipe size, as this is the smallest size pipe recommended to be used for ammonia suction mains. If single feed is used the 1/2-inch size pipe is proper for the suction main, provided the length of the main does not exceed 25 feet; that is, from the outlet of the last coil to the compressor.

For Dichlorodifluoromethane, F12.

Refer to Table III., October issue. The smaller refrigerator of 2000 B.t.u. per hour capacity will require one evaporator of 3/4-inch size tube. The larger refrigerator requires two evaporators of 1-inch standard pipe or three evaporators of 3/4-inch size tube. Refer to Table VIII. for the proper size suction mains.

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TABLE Y — Size of Suction Mains for Ammonia, NH_3

Temp. of Suction Gas, Deg. Fahr.	Suction Main Velocity Ft. Per Min.	Displacement Cu. In. Per Min. Per Ton Refrigeration	CARRYING CAPACITIES OF SUCTION MAINS																			
			½ In. Ex. Hy. Pipe 0.824 Sq. In. Area		¾ In. Ex. Hy. Pipe 0.433 Sq. In. Area		1 In. Ex. Hy. Pipe 0.719 Sq. In. Area		1¼ In. Ex. Hy. Pipe 1.283 Sq. In. Area	1½ In. Ex. Hy. Pipe 1.767 Sq. In. Area	2 In. Ex. Hy. Pipe 2.953 Sq. In. Area	2½ In. Std. Pipe 4.788 Sq. In. Area	3 In. Std. Pipe 7.393 Sq. In. Area	3½ In. Std. Pipe 9.566 Sq. In. Area	4 In. Std. Pipe 12.730 Sq. In. Area	5 In. Std. Pipe 20.006 Sq. In. Area	6 In. Std. Pipe 28.891 Sq. In. Area	
			Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	
90	6710	10885	1.73	20760	3.80	38400	5.38	63840	9.49	13.00	21.83	35.40	54.66	73.09	94.12	147.91	213.60			
88	6547	10342	1.78	21360	3.88	39360	5.47	65640	9.76	13.37	22.46	36.42	56.24	75.30	96.84	152.18	219.77			
86	6384	9824	1.82	21840	3.97	40440	5.59	67080	9.98	13.67	22.97	37.24	57.50	76.89	99.01	155.60	224.71			
84	6239	9345	1.87	22440	3.46	41520	5.75	69000	10.25	14.05	23.60	38.26	59.08	79.00	101.73	159.88	230.88			
82	6083	8888	1.92	23040	3.55	42600	5.90	70800	10.53	14.43	24.23	39.29	60.66	81.12	104.45	164.15	237.05			
80	5939	8463	1.97	23640	3.65	43800	6.05	72600	10.80	14.80	24.86	40.31	62.24	83.23	107.17	168.43	243.23			
78	5801	8081	2.02	24240	3.74	44880	6.21	74520	11.08	15.18	25.49	41.33	63.82	85.34	109.89	172.70	249.40			
76	5667	7684	2.07	24840	3.83	45960	6.36	76320	11.35	15.55	26.12	42.36	65.40	87.45	112.61	176.98	255.57			
74	5536	7321	2.12	25440	3.92	47040	6.51	78120	11.62	15.93	26.75	43.38	66.98	89.57	115.33	181.25	261.75			
72	5410	6981	2.18	26160	4.03	48360	6.70	80400	11.95	16.38	27.51	44.61	68.87	92.10	118.60	186.38	269.16			
70	5289	6664	2.23	26760	4.13	49560	6.85	82200	12.23	16.75	28.14	45.63	70.45	94.21	121.32	190.66	275.33			
68	5288	6506	2.26	27120	4.18	50160	6.94	83280	12.39	16.98	28.52	46.24	71.40	95.48	122.95	193.22	279.03			
66	5168	6358	2.28	27360	4.22	50640	7.01	84120	12.50	17.13	28.77	46.65	72.03	96.33	124.04	194.93	281.50			
64	5118	6215	2.31	27720	4.27	51240	7.10	85200	12.67	17.36	29.15	47.27	72.98	97.59	125.67	197.50	285.21			
62	5055	6073	2.34	28080	4.33	51960	7.19	86280	12.83	17.58	29.53	47.88	73.93	98.86	127.30	200.06	288.91			
60	5000	5937	2.36	28320	4.37	52440	7.25	87000	12.94	17.73	29.78	48.29	74.56	99.71	128.39	201.77	291.38			
58	4944	5802	2.39	28680	4.42	53040	7.34	88080	13.10	17.96	30.16	48.90	75.51	100.97	130.02	204.34	295.08			
56	4892	5676	2.42	29040	4.48	53760	7.44	89280	13.27	18.18	30.54	49.52	76.46	102.24	131.65	206.90	298.79			
54	4837	5547	2.45	29400	4.53	54360	7.53	90360	13.43	18.41	30.92	50.13	77.41	103.51	133.28	209.47	302.49			
52	4783	5419	2.48	29760	4.59	55080	7.62	91440	13.60	18.63	31.30	50.75	78.36	104.78	134.90	212.03	306.20			
50	4731	5300	2.51	30120	4.64	55680	7.71	92520	13.76	18.86	31.64	51.36	79.30	106.04	136.53	214.59	309.90			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			

Continued on Next Page

TABLE V – CONT. – SIZE OF SUCTION MAINS FOR AMMONIA, NH_3

11	4683	5188	2.53	30360	4.68	56160	7.77	93240	13.87	19.01	31.93	51.77	79.93	106.89	137.64	216.30	312.37
12	4634	5075	2.56	30720	4.74	56880	7.87	94440	14.04	19.23	32.31	52.38	80.88	108.15	139.27	218.87	316.07
13	4584	4964	2.59	31080	4.79	57480	7.96	95520	14.20	19.46	32.69	53.00	81.83	109.42	140.90	221.43	319.78
14	4533	4852	2.62	31440	4.85	58200	8.05	96600	14.37	19.68	33.06	53.61	82.78	110.69	142.53	224.00	323.48
15	4485	4749	2.65	31800	4.90	58800	8.14	97680	14.53	19.91	33.44	54.22	83.72	111.96	144.17	226.56	327.18
16	4442	4652	2.68	32160	4.96	59520	8.23	98760	14.69	20.14	33.82	54.84	84.67	113.22	145.80	229.13	330.89
17	4393	4548	2.71	32520	5.01	60120	8.33	99960	14.86	20.36	34.20	55.45	85.62	114.49	147.43	231.69	334.59
18	4347	4450	2.74	32880	5.07	60840	8.42	101040	15.02	20.59	34.58	56.07	86.57	115.76	149.06	234.26	338.30
19	4302	4355	2.77	33240	5.13	61560	8.51	102120	15.19	20.81	34.96	56.68	87.52	117.03	150.69	236.82	342.00
20	4258	4265	2.80	33600	5.18	62160	8.60	103200	15.35	21.04	35.34	57.29	88.46	118.29	152.33	239.39	345.70
21	4214	4176	2.83	33960	5.24	62880	8.70	104400	15.52	21.26	35.71	57.91	89.41	119.56	153.96	241.95	349.41
22	4170	4088	2.86	34320	5.30	63600	8.79	105480	15.68	21.49	36.09	58.52	90.36	120.83	155.59	244.52	353.11
23	4130	4006	2.89	34680	5.35	64200	8.88	106560	15.85	21.71	36.47	59.14	91.31	122.10	157.22	247.08	356.82
24	4084	3917	2.93	35160	5.42	65040	9.00	108000	16.06	22.01	36.98	59.95	92.57	123.79	159.40	250.50	361.76
25	4044	3836	2.96	35520	5.48	65760	9.10	109200	16.23	22.24	37.36	60.57	93.52	125.05	161.03	253.07	365.46
26	4006	3761	2.99	35880	5.53	66360	9.19	110280	16.39	22.46	37.73	61.18	94.47	126.32	162.66	255.63	369.16
27	3964	3680	3.02	36240	5.59	67080	9.28	111360	16.56	22.69	38.11	61.80	95.41	127.59	164.29	258.20	372.87
28	3925	3607	3.06	36720	5.66	67920	9.40	112800	16.78	22.99	38.62	62.61	96.68	129.28	166.47	261.62	377.81
29	3885	3533	3.09	37080	5.72	68640	9.49	113880	16.94	23.22	39.00	63.23	97.63	130.55	168.10	264.18	381.51
30	3850	3466	3.12	37440	5.77	69240	9.59	115080	17.11	23.44	39.37	63.84	98.57	131.81	169.73	266.75	385.21
31	3809	3393	3.15	37800	5.83	69960	9.68	116160	17.27	23.67	39.75	64.46	99.52	133.08	171.37	269.31	388.92
32	3773	3327	3.18	38160	5.88	70560	9.77	117240	17.44	23.89	40.13	65.07	100.47	134.35	173.00	271.88	392.62
33	3736	3260	3.22	38640	5.96	71520	9.89	118680	17.65	24.19	40.64	65.89	101.73	136.04	175.17	275.30	397.56
34	3699	3194	3.25	39000	6.01	72120	9.99	119880	17.82	24.42	41.02	66.50	102.68	137.31	176.81	277.86	401.26
35	3661	3128	3.29	39480	6.09	73080	10.11	121320	18.04	24.72	41.52	67.32	103.94	139.00	178.98	281.28	406.20
36	3627	3069	3.32	39840	6.14	73680	10.20	122400	18.20	24.94	41.90	67.93	104.89	140.26	180.61	283.85	409.91
37	3594	3010	3.35	40200	6.20	74400	10.29	123480	18.37	25.17	42.28	68.55	105.84	141.53	182.25	286.41	413.61
38	3559	2952	3.39	40680	6.27	75240	10.42	125040	18.59	25.47	42.78	69.37	107.10	143.22	184.42	289.83	418.55
39	3524	2893	3.42	41040	6.33	75960	10.51	126120	18.75	25.70	43.16	69.98	108.05	144.49	186.05	292.40	422.25
40	3491	2834	3.46	41520	6.40	76800	10.63	127560	18.97	26.00	43.67	70.80	109.32	146.18	188.23	295.82	427.19
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Use next larger size pipe if suction main is longer than 25 ft.

Use next larger size pipe if suction main is longer than 50 ft.

Use next larger size pipe if suction main is longer than 100 ft.

TABLE VI — Size of Suction Mains for Methyl Chloride, CH_3Cl

Temp. of Suction Gas Deg. Fahr.	Suction Main Velocity, Ft. per Min.	Displacement Cu. In. per Min. per Ton Refrigeration	Carrying Capacities of Suction Mains							
			⅜ In. Tube 0.07306 Sq. In. Area		½ In. Tube 0.12756 Sq. In. Area		⅝ In. Tube 0.2419 Sq. In. Area		¾ In. Tube 0.34837 Sq. In. Area	
			Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour
−10	4379	15984	0.240	2880	0.419	5028	0.795	9540	1.144	13728
9	4309	15471	0.244	2928	0.426	5112	0.808	9696	1.163	13956
8	4874	15099	0.248	2976	0.433	5196	0.821	9852	1.182	14184
7	4921	14703	0.252	3024	0.440	5280	0.834	10008	1.202	14424
6	4177	14420	0.254	3048	0.443	5316	0.841	10092	1.211	14532
5	4142	14118	0.257	3084	0.449	5388	0.851	10212	1.225	14700
4	4098	13753	0.261	3132	0.456	5472	0.864	10368	1.244	14928
3	4055	13464	0.264	3168	0.461	5532	0.874	10488	1.259	15108
2	4011	13136	0.268	3216	0.468	5616	0.887	10644	1.278	15336
1	3972	12859	0.271	3252	0.473	5676	0.897	10764	1.292	15504
0	3935	12566	0.275	3300	0.480	5760	0.911	10932	1.311	15732
+ 1	3897	12283	0.278	3336	0.485	5820	0.920	11040	1.326	15912
2	3843	11911	0.283	3396	0.494	5928	0.937	11244	1.349	16188
3	3797	11614	0.287	3444	0.501	6012	0.950	11400	1.368	16416
4	3757	11343	0.290	3480	0.506	6072	0.960	11520	1.383	16596
5	3724	11147	0.293	3516	0.512	6144	0.970	11640	1.397	16764
6	3696	10936	0.296	3552	0.517	6204	0.980	11760	1.411	16932
7	3661	10725	0.299	3588	0.522	6264	0.990	11880	1.426	17112
8	3632	10507	0.303	3636	0.529	6348	1.003	12036	1.445	17340
9	3597	10282	0.307	3684	0.536	6432	1.016	12192	1.464	17568
10	3571	10090	0.310	3720	0.541	6492	1.026	12312	1.478	17736
11	3524	9826	0.314	3768	0.548	6576	1.040	12480	1.497	17964
12	3485	9611	0.318	3816	0.555	6660	1.053	12636	1.516	18192
13	3450	9397	0.322	3864	0.562	6744	1.066	12792	1.535	18420
14	3412	9160	0.327	3924	0.571	6852	1.083	12996	1.559	18708
15	3365	8893	0.332	3984	0.580	6960	1.099	13188	1.583	18996
16	3342	8750	0.335	4020	0.585	7020	1.109	13308	1.597	19164
17	3310	8574	0.338	4056	0.590	7080	1.119	13428	1.612	19344
18	3275	8358	0.344	4128	0.601	7212	1.139	13668	1.640	19680
19	3247	8197	0.347	4164	0.606	7272	1.149	13788	1.654	19848
20	3217	8013	0.352	4224	0.615	7380	1.165	13980	1.678	20136
21	3188	7853	0.356	4272	0.622	7464	1.179	14148	1.697	20364
22	3156	7688	0.360	4320	0.629	7548	1.192	14304	1.716	20592
23	3118	7488	0.365	4380	0.637	7644	1.209	14508	1.740	20880
24	3100	7372	0.369	4428	0.644	7728	1.222	14664	1.759	21108
25	3069	7215	0.373	4476	0.651	7812	1.235	14820	1.778	21336
26	3037	7058	0.377	4524	0.658	7896	1.248	14976	1.798	21576
27	3009	6907	0.382	4584	0.667	8004	1.265	15180	1.821	21852
28	2977	6752	0.387	4644	0.676	8112	1.281	15372	1.845	22140
29	2942	6597	0.391	4692	0.683	8196	1.295	15540	1.864	22368
30	2914	6443	0.397	4764	0.693	8316	1.314	15768	1.893	22716
31	2897	6363	0.400	4800	0.698	8376	1.324	15888	1.907	22884
32	2865	6210	0.404	4848	0.705	8460	1.338	16056	1.926	23112
33	2839	6104	0.408	4896	0.712	8544	1.351	16212	1.945	23340
34	2813	5952	0.414	4968	0.723	8676	1.371	16452	1.974	23688
35	2787	5851	0.418	5016	0.730	8760	1.384	16608	1.993	23916
36	2766	5723	0.424	5088	0.740	8880	1.404	16848	2.022	24264
37	2736	5622	0.427	5124	0.746	8952	1.414	16968	2.036	24432
38	2715	5495	0.433	5196	0.756	9012	1.434	17208	2.065	24780
39	2692	5391	0.438	5256	0.765	9180	1.450	17400	2.088	25056
40	2666	5292	0.442	5304	0.772	9264	1.463	17556	2.107	25284
			Use next larger size pipe if suction main is longer than 25 ft.		Use next larger size pipe if suction main is longer than 50 ft.		Use next larger size pipe if suction main is longer than 100 ft.			

TABLE VII—Size of Suction Mains for Sulphur Dioxide, SO_2

Temp. of Suction Gas Deg. Fahr.	Suction Main Velocity, Ft. per Min.	Displacement Cu. In. per Min. per Ton Refrigeration	Carrying Capacities of Suction Mains							
			⅜ In. Tube 0.07306 Sq. In. Area		½ In. Tube 0.12756 Sq. In. Area		¾ In. Tube 0.2419 Sq. In. Area		⅞ In. Tube 0.34837 Sq. In. Area	
			Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour
0	4725	17850	0.232	2784	0.405	4860	0.768	9216	1.106	13272
+ 1	4666	17393	0.235	2820	0.410	4920	0.778	9336	1.120	13440
2	4608	16953	0.238	2856	0.416	4992	0.788	9456	1.135	13620
3	4550	16522	0.241	2892	0.421	5052	0.798	9576	1.149	13788
4	4494	16104	0.245	2940	0.428	5136	0.811	9732	1.168	14016
5	4438	15697	0.248	2976	0.433	5196	0.821	9852	1.182	14184
6	4384	15308	0.251	3012	0.438	5256	0.831	9972	1.197	14364
7	4331	14929	0.254	3048	0.443	5316	0.841	10092	1.211	14532
8	4279	14562	0.258	3096	0.450	5400	0.854	10248	1.230	14760
9	4226	14201	0.261	3132	0.456	5472	0.864	10368	1.244	14928
10	4175	13853	0.264	3168	0.461	5532	0.874	10488	1.259	15108
11	4123	13520	0.268	3216	0.468	5616	0.887	10644	1.278	15336
12	4076	13194	0.271	3252	0.473	5676	0.897	10764	1.292	15504
13	4028	12876	0.274	3288	0.478	5736	0.907	10884	1.306	15672
14	3979	12566	0.278	3336	0.485	5820	0.920	11040	1.326	15912
15	3932	12263	0.281	3372	0.491	5892	0.930	11160	1.340	16080
16	3886	11976	0.284	3408	0.496	5952	0.940	11280	1.354	16248
17	3843	11694	0.288	3456	0.503	6036	0.954	11448	1.373	16476
18	3797	11419	0.292	3504	0.510	6120	0.967	11604	1.392	16704
19	3753	11152	0.295	3540	0.515	6180	0.977	11724	1.407	16884
20	3710	10890	0.299	3588	0.522	6264	0.990	11880	1.426	17112
21	3668	10640	0.302	3624	0.527	6324	1.000	12000	1.440	17280
22	3627	10396	0.306	3672	0.534	6408	1.013	12156	1.459	17508
23	3585	10157	0.309	3708	0.540	6480	1.023	12276	1.473	17676
24	3545	9925	0.313	3756	0.546	6552	1.036	12432	1.492	17904
25	3501	9675	0.317	3804	0.553	6636	1.050	12600	1.511	18132
26	3466	9480	0.321	3852	0.560	6720	1.063	12756	1.531	18372
27	3428	9269	0.324	3888	0.566	6792	1.073	12876	1.545	18540
28	3389	9060	0.328	3936	0.573	6876	1.086	13032	1.564	18768
29	3352	8859	0.332	3984	0.580	6960	1.099	13188	1.583	18996
30	3314	8661	0.335	4020	0.585	7020	1.109	13308	1.597	19164
31	3279	8470	0.339	4068	0.592	7104	1.122	13464	1.616	19392
32	3247	8308	0.342	4104	0.597	7164	1.132	13584	1.631	19572
33	3209	8108	0.347	4164	0.606	7272	1.149	13788	1.654	19848
34	3174	7931	0.351	4212	0.613	7356	1.162	13944	1.674	20088
35	3139	7757	0.355	4260	0.620	7440	1.175	14100	1.693	20316
36	3105	7591	0.359	4308	0.627	7524	1.189	14268	1.711	20532
37	3072	7430	0.362	4344	0.632	7584	1.199	14388	1.726	20712
38	3040	7272	0.366	4392	0.639	7668	1.212	14544	1.745	20940
39	3007	7116	0.370	4440	0.646	7752	1.225	14700	1.764	21168
40	2976	6965	0.375	4500	0.655	7860	1.242	14904	1.788	21456
			Use next larger size pipe if suction main is longer than 25 ft.		Use next larger size pipe if suction main is longer than 50 ft.		Use next larger size pipe if suction main is longer than 100 ft.			

TABLE VIII — Size of Suction Mains for Dichlorodifluoromethane, F12

Temp. of Suction Gas Deg. Fahr.	Suction Main Velocity Ft. per Min.	Displacement Cu. In per Min. per Ton Refrigeration	Carrying Capacities of Suction Mains																
			½ In. Ex. Hy. Pipe 0.234 Sq. In. Area		¾ In. Ex. Hy. Pipe 0.433 Sq. In. Area		1 In. Std. Pipe 0.864 Sq. In. Area		1¼ In. Std. Pipe 1.495 Sq. In. Area		1½ In. Std. Pipe 2.036 Sq. In. Area		2 In. Std. Pipe 3.355 Sq. In. Area	2½ In. Std. Pipe 4.788 Sq. In. Area	3 In. Std. Pipe 7.393 Sq. In. Area	3½ In. Std. Pipe 9.886 Sq. In. Area	4 In. Std. Pipe 12.730 Sq. In. Area	5 In. Std. Pipe 20.006 Sq. In. Area	6 In Std. Pipe 28.891 Sq. In. Area
			Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	B.t.u. per Hour	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage	Tonnage
−20	2755	17750	0.436	5232	0.807	9684	1.610	19320	2.786	33432	3.794	45528	6.25	8.98	13.77	18.42	23.72	37.28	53.83
−18	2697	16926	0.447	5364	0.827	9924	1.650	19800	2.856	34272	3.889	46668	6.41	9.15	14.12	18.88	24.32	38.22	55.19
−16	2639	16141	0.459	5508	0.849	10188	1.695	20340	2.933	35196	3.994	47928	6.58	9.39	14.50	19.39	24.97	39.24	56.67
−14	2583	15402	0.471	5652	0.872	10464	1.739	20868	3.009	36108	4.098	49176	6.75	9.64	14.88	19.90	25.62	40.27	58.15
−12	2525	14690	0.483	5796	0.894	10728	1.783	21396	3.086	37032	4.203	50436	6.93	9.88	15.26	20.41	26.28	41.29	59.63
−10	2478	14031	0.496	5952	0.918	11016	1.831	21972	3.169	38028	4.316	51792	7.11	10.15	15.67	20.96	26.98	42.41	61.24
−8	2427	13401	0.509	6108	0.942	11304	1.879	22548	3.252	39024	4.429	53148	7.30	10.42	16.08	21.50	27.69	43.52	62.84
−6	2378	12804	0.522	6264	0.966	11592	1.927	23124	3.335	40020	4.542	54504	7.48	10.68	16.49	22.05	28.40	44.63	64.45
−4	2331	12241	0.535	6420	0.990	11880	1.975	23700	3.418	41016	4.655	55860	7.67	10.95	16.90	22.60	29.11	45.74	66.05
−2	2286	11709	0.548	6576	1.014	12168	2.023	24276	3.501	42012	4.768	57216	7.86	11.21	17.31	23.15	29.81	46.85	67.66
0	2242	11204	0.562	6744	1.040	12480	2.075	24900	3.591	43092	4.890	58680	8.06	11.50	17.76	23.74	30.57	48.05	69.39
+ 1	2222	10995	0.568	6816	1.051	12612	2.097	25164	3.629	43548	4.942	59304	8.14	11.62	17.95	23.99	30.90	48.56	70.13
2	2198	10784	0.576	6912	1.066	12792	2.127	25524	3.680	43960	5.012	60144	8.26	11.79	18.20	24.33	31.34	49.25	71.12
3	2177	10496	0.587	6984	1.077	12924	2.149	25788	3.718	44616	5.064	60768	8.34	11.91	18.39	24.59	31.66	49.76	71.86
4	2154	10268	0.589	7068	1.090	13080	2.175	26100	3.763	45156	5.125	61500	8.45	12.05	18.61	24.88	32.04	50.36	72.72
5	2135	10048	0.597	7164	1.105	13260	2.204	26448	3.814	45768	5.194	62328	8.56	12.22	18.86	25.22	32.48	51.04	73.71
6	2114	9836	0.604	7248	1.118	13416	2.230	26760	3.859	46308	5.255	63060	8.66	12.36	19.08	25.52	32.86	51.64	74.57
7	2095	9635	0.610	7320	1.129	13548	2.252	27024	3.897	46764	5.308	63696	8.75	12.48	19.27	25.77	33.19	52.15	75.31
8	2074	9431	0.618	7416	1.144	13728	2.282	27384	3.948	47376	5.377	64524	8.86	12.65	19.53	26.11	33.62	52.84	76.30
9	2054	9233	0.625	7500	1.156	13872	2.308	27696	3.993	47916	5.438	65256	8.96	12.79	19.75	26.41	34.00	53.43	77.17
10	2035	9041	0.632	7584	1.169	14028	2.334	28008	4.038	48456	5.499	65988	9.06	12.92	19.97	26.70	34.38	54.03	78.03
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Continued on Next Page

TABLE VIII – CONT. – Size of Suction Mains for Dichlorodifluoromethane, F12

11	2018	8856	0.640	7680	1.184	14208	2.363	28356	4.089	49068	5.569	66828	9.18	13.10	20.22	27.04	34.82	54.72	79.02
12	1998	8669	0.647	7764	1.197	14364	2.389	28668	4.134	49608	5.630	67560	9.28	13.24	20.44	27.33	35.20	55.32	79.88
13	1979	8490	0.655	7860	1.212	14544	2.418	29016	4.185	50220	5.699	68388	9.39	13.40	20.69	27.67	35.63	56.00	80.87
14	1960	8312	0.662	7944	1.225	14700	2.444	29328	4.230	50760	5.760	69120	9.49	13.55	20.92	27.97	36.01	56.60	84.73
15	1942	8141	0.670	8040	1.240	14880	2.474	29688	4.281	51372	5.830	69960	9.61	13.71	21.17	28.31	36.45	57.28	82.78
16	1925	7971	0.678	8136	1.255	15060	2.503	30036	4.332	51984	5.899	70788	9.72	13.87	21.42	28.64	36.88	57.97	83.71
17	1907	7811	0.686	8232	1.269	15228	2.533	30396	4.383	52596	5.969	71628	9.84	14.04	21.67	28.98	37.32	58.65	84.70
18	1888	7648	0.693	8316	1.282	15384	2.559	30708	4.428	53136	6.030	72360	9.94	14.18	21.89	29.28	37.70	59.25	85.56
19	1872	7494	0.701	8412	1.297	15564	2.588	31056	4.479	53748	6.099	73188	10.05	14.34	22.15	29.62	38.14	59.93	86.55
20	1855	7342	0.709	8508	1.312	15744	2.618	31416	4.530	54360	6.169	74028	10.17	14.51	22.40	29.95	38.57	60.62	87.54
21	1837	7195	0.717	8604	1.327	15924	2.647	31764	4.581	54972	6.239	74868	10.28	14.67	22.65	30.29	39.01	61.30	88.53
22	1821	7050	0.725	8700	1.342	16104	2.677	32124	4.632	55584	6.308	75696	10.39	14.83	22.91	30.63	39.44	61.98	89.51
23	1806	6910	0.734	8808	1.358	16296	2.710	32520	4.689	56268	6.387	76644	10.52	15.02	23.19	31.01	39.93	62.75	90.62
24	1788	6772	0.741	8892	1.371	16452	2.736	32832	4.734	56808	6.447	77364	10.62	15.16	23.41	31.31	40.31	63.35	91.49
25	1772	6639	0.749	8988	1.386	16632	2.766	33192	4.785	57420	6.517	78204	10.74	15.33	23.66	31.64	40.75	64.04	92.48
26	1757	6511	0.758	9096	1.403	16836	2.799	33588	4.843	58116	6.595	79140	10.87	15.51	23.95	32.02	41.24	64.81	93.59
27	1743	6388	0.766	9192	1.417	17004	2.828	33936	4.894	58728	6.665	79980	10.98	15.67	24.20	32.36	41.67	65.49	94.57
28	1727	6264	0.774	9288	1.432	17184	2.858	34296	4.945	59340	6.735	80820	11.10	15.84	24.45	32.70	42.11	66.17	95.56
29	1713	6143	0.783	9396	1.449	17388	2.891	34692	5.003	60036	6.813	81756	11.23	16.02	24.74	33.08	42.60	66.94	96.67
30	1697	6022	0.791	9492	1.464	17568	2.921	35052	5.054	60648	6.882	82584	11.34	16.19	24.99	33.42	43.03	67.63	97.66
31	1683	5918	0.799	9588	1.478	17736	2.950	35400	5.105	61260	6.952	83424	11.47	16.35	25.24	33.76	43.47	68.31	98.65
32	1669	5799	0.808	9696	1.495	17940	2.983	35796	5.162	61944	7.030	84360	11.59	16.53	25.53	34.14	43.96	69.08	99.76
33	1655	5687	0.817	9804	1.512	18144	3.017	36204	5.220	62640	7.109	85308	11.71	16.72	25.81	34.52	44.45	69.85	100.87
34	1639	5578	0.825	9900	1.527	18324	3.046	36552	5.271	63252	7.178	86136	11.83	16.88	26.07	34.85	44.88	70.53	101.86
35	1625	5473	0.834	10008	1.543	18516	3.079	36948	5.328	63936	7.257	87084	11.96	17.07	26.35	35.23	45.37	71.30	102.97
36	1613	5372	0.843	10116	1.560	18720	3.113	37356	5.386	64632	7.335	88020	12.09	17.25	26.63	35.62	45.86	72.07	104.08
37	1599	5267	0.852	10224	1.577	18924	3.146	37752	5.443	65316	7.413	88956	12.22	17.43	26.92	36.00	46.35	72.84	105.19
38	1585	5168	0.861	10332	1.593	19116	3.179	38148	5.501	66012	7.492	89904	12.34	17.62	27.20	36.38	46.84	73.61	106.30
39	1571	5068	0.870	10440	1.610	19320	3.212	38544	5.558	66696	7.570	90840	12.47	17.80	27.49	36.76	47.33	74.38	107.42
40	1559	4978	0.879	10548	1.626	19512	3.246	38952	5.616	67392	7.648	91776	12.60	17.99	27.77	37.14	47.82	75.15	108.53
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Use next larger size pipe if suction main is longer than 25 ft.

Use next larger size pipe if suction main is longer than 50 ft.

Use next larger size pipe if suction main is longer than 100 ft

The smaller refrigerator with one evaporator would have a suction main of ½-inch extra heavy pipe and each of the evaporators in the large refrigerator would also have a suction connection of ½-inch extra heavy pipe.

The ½-inch pipe suction main from the smaller refrigerator would continue in this size up to the point of entry of the last evaporator connection. At this point the size of the suction main is to be increased to ¾-inch extra heavy pipe and to continue so to the compressor.

For Sulphur Dioxide, SO_2.

Reference to Table IV., November issue, shows that the small refrigerator of 2000 B.t.u. per hour capacity will require one evaporator, providing ⅝-inch size tubing is used for the coil.

The refrigerator of 7000 B.t.u. per hour capacity, would require four evaporators of ⅝-inch size tubing, since this size tube will only carry away the vapors at a 20 degree F. suction gas for a refrigerating load of 2252 B.t.u. per hour and maintain the proper velocity of 704 feet per minute at the coil outlet.

For the proper size of the suction mains to use with sulphur dioxide for the above example refer to Table VII.

A ⅜-inch tube will carry the gas evaporated by a refrigerating load of 3588 B.t.u. per hour; therefore this size tubing should be used at the outlet of the small refrigerator evaporator and each of the four evaporators in the larger refrigerator.

This ⅜-inch tube size suction main should be increased to ½-inch tube where the first of the four large refrigerator evaporator connections enters same and to continue in this ½-inch size up to the point of entry of the third evaporator connection and increased to ⅝-inch tube for the third and fourth evaporator and so to the compressor suction.

The method of selecting evaporators and suction main sizes for a large plant is just as simple.

The following example will be outlined in the two refrigerants most probable to be used for such size plants:

Example

Using Ammonia, NH_3.

Having a refrigerating plant with an ice plant in connection, operating with 5 degrees F. suction gas and using ammonia as the refrigerant. The various refrigerators are listed in the sequence in which the outlets of the evaporators enter into the suction main, all evaporator coils being of 1¼-inch extra heavy pipe unless otherwise noted.

Refrigerator No. 1.—5-ton refrigerating duty or 60,000 B.t.u./Hr.

Refrigerator No. 2.—1-ton refrigerating duty or 12,000 B.t.u./Hr.

Refrigerator No. 3.—10-ton refrigerating duty or 120,000 B.t.u./Hr. Ice making tank, 15-ton ice capacity or refrigerating duty of 25 tons, 300,000 B.t.u. per hour.

See Table I., August issue, and accompanying Table V.

Refrigerator No. 1 requires two evaporators, each having a suction connection of ¾-inch extra heavy pipe.

Refrigerator No. 2 requires one evaporator of 1¼-inch or 1-inch extra heavy pipe. Refrigerators of this size should have at least two evaporators; therefore two ¾-inch extra heavy pipe coils could be used, each having a suction connection of ½-inch extra heavy pipe.

Refrigerator No. 3 requires four evaporators, each having a suction connection of ¾-inch extra heavy pipe.

Ice making tank, if straight expansion coils are used, would require ten coils of 1¼-inch extra heavy pipe, each with an outlet of ¾-inch extra heavy pipe into a header. The main outlet of this header or from a shell type evaporator should be 2-inch extra heavy pipe.

The suction main would be of the following sizes: Beginning with ¾-inch extra heavy pipe for the first evaporator; increasing to 1-inch extra heavy pipe at entry of the second evaporator; continuing 1-inch for third and fourth evaporator; 1¼-inch extra heavy pipe for fifth and sixth evaporator; 1½-inch extra heavy pipe for seventh and eighth evaporator; and increasing to 2½-inch standard pipe for ice tank evaporator entry, and so to the compressor.

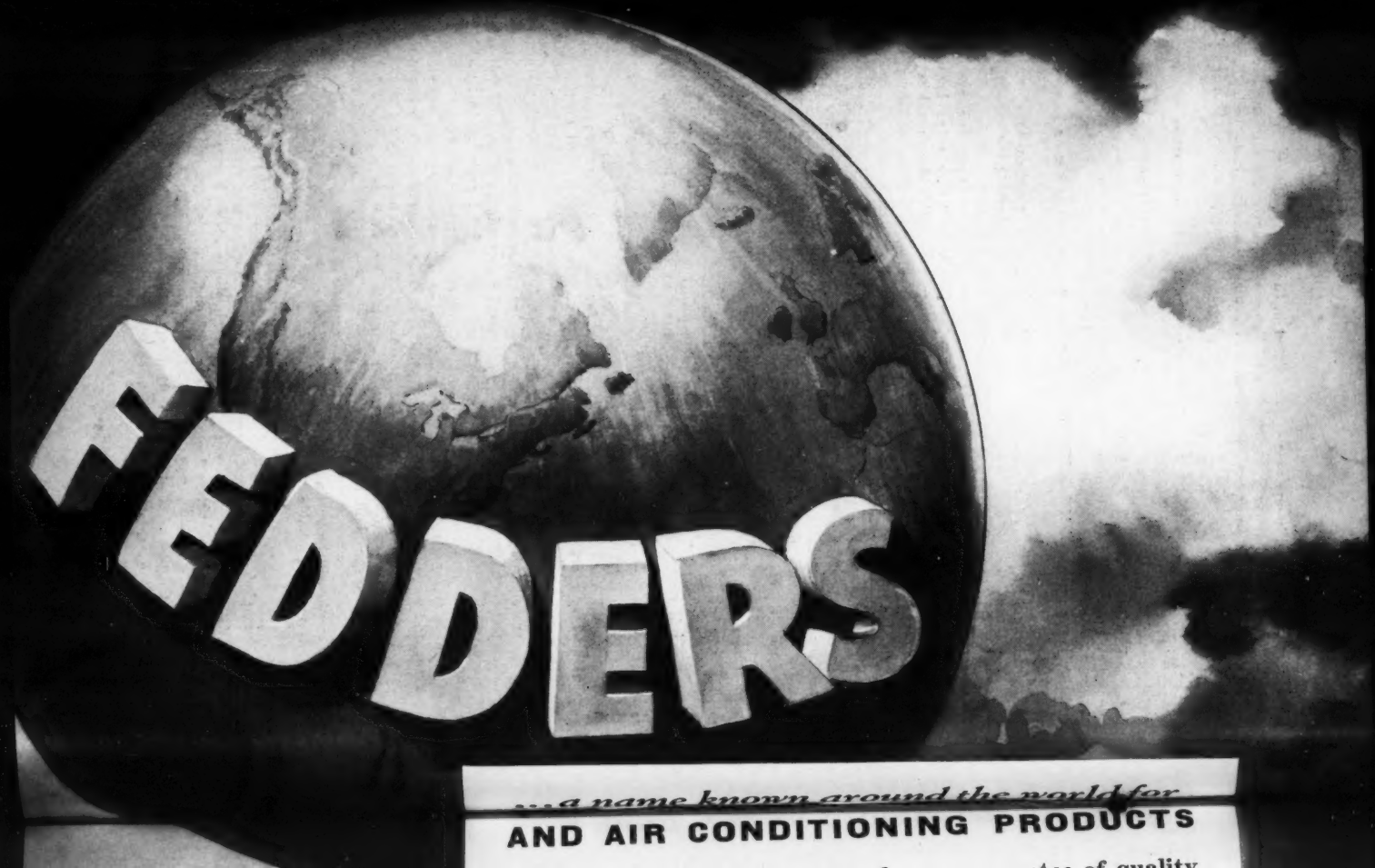
Should the suction connections between the main suction line and evaporator exceed 25 feet in length it is recommended to increase the size of the individual connection one pipe size.

Using Dichlorodifluoromethane, F12.

Refer to Table III., October issue, and Table VIII.

Refrigerator No. 1 requires three evaporators of 2-inch pipe size and a suction line of 1-inch pipe from each evaporator.

Refrigerator No. 2 requires two evaporators of 1¼-inch pipe size and a suction connection of ½-inch extra heavy pipe size from each evaporator.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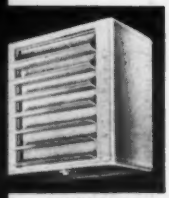

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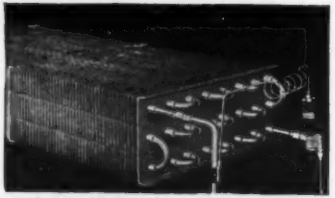

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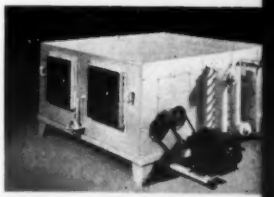

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Refrigerator No. 3 requires six evaporators of 2-inch pipe size and a suction connection of 1-inch pipe size from each evaporator.

Ice making tank, if straight expansion coils are used, would require thirty coils of 1¼-inch pipe size, each having an outlet of ¾-inch extra heavy pipe size into a header. Since thirty coils would be too many to place in the width of an ice tank of this size it is suggested that a set of headers be placed at each end of the tank, each bank of fifteen coils being connected to separate headers. Using two banks of coils, the outlet of each suction header should be large enough to carry the gases generated by a refrigerating load of 150,000 B.t.u. per hour or 12½ tons refrigeration; this could be a 2½-inch standard pipe size.

The suction main would be of the following sizes: Beginning with 1-inch pipe for the first evaporator; increasing to 1¼-inch pipe at entry of second evaporator connection; to 1½-inch pipe at entry of third evaporator connection; to 2-inch pipe for fourth evaporator; continuing 2-inch for fifth and sixth evaporator; increasing to 2½-inch pipe for seventh and eighth evaporator; increasing to 3-inch pipe for ninth, tenth and eleventh evaporator.

At entry of the first header connection at ice tank the suction main is to be increased to 4-inch pipe and increased to 5-inch pipe at entry of the second ice tank header connection, and so to the compressor suction inlet.

(Concluded)

Trials of a Used Refrigerator Buyer

THE following is the diary of a purchaser of a used refrigerator, for which he paid the total sum of $50.00.

While the information conveyed by the diary is humorous in some respects, it also contains a good example of what happens to both the customer and the service company through the sale of "As Is" refrigerators at low prices. A thorough overhaul and an increase in price to cover the work would, in such cases, have eliminated considerable trouble and expense for both the customer and service company, and saved the industry, as a whole, a probable black eye.

July 3—Refrigerator was delivered by truck to Lakeside, Mich. Started it up and spent most of the night trying to find out why it was bouncing around so much in its spring-suspended carriage. After putting a small block of wood under one end to stop some of the noise, it finally stopped entirely by the next morning.

July 4—Put in long distance call to St. Joe for a repairman.

July 5—Repairman called and found the motor burned out. Installed temporary motor and shipped old motor to Detroit for repairs. Repairman also found seal leak, defective expansion valve, and cooling unit in bad condition.

July 6—Temporary motor started bouncing around so bad had to shut it down to save this one from burning out.

July 9—Repairman called and took entire machine from lower part of box to St. Joe for repairs.

July 21—(No use of refrigerator so far.) Repairman returned with machine and installed same, excepting old motor still in Detroit for repairs.

July 24—Machine worked up until today. Had to shut it down today as temperature would not go below 70 degrees on account of seal leak.

July 27—Machine shut down until today, when repairman called and injected gas into compressor.

July 30—Repairman called again and injected more gas, and he was ordered to put in a new adjustable expansion valve, as the old one was non-adjustable.

Aug. 6—Adjustable expansion valve installed today, and more gas injected into the compressor.

Aug. 8—Machine shut down again on account of gas leak. Could not get temperature below 70 degrees.

Aug. 10—Repairman called again and installed, or rather injected, more gas in the compressor.

Aug. 15—Machine shut down again on account of gas leak.

Aug. 17—Repairman called and injected more gas.

Aug. 24—Shut down again on account of gas leak. Decided not to try to use refrigerator any further.

Aug. 31—(Last day of vacation). Repairman called and took out his temporary motor.

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box."

MAJESTIC MODEL 51

QUESTION 230. I bought a standard Majestic unit, Model No. 51, with 4½ or 5 ft. cabinet from our local electric company. When I bought the outfit, the unit was pulled out and the manager said all it needed was a new seal (the compressor is a rotary squeeze). I installed a new seal and pumped a vacuum to test for leaks. I ran the compressor (speed 475 r.p.m.) for about 8 or 10 minutes, and all at once, the compressor stuck tight, but the wheel could be turned by hand with force. I pulled the compressor apart, but the rotor mechanism was in a welded sealed housing. I ground the spot welds off and opened up. All the fittings were very tight and came apart hard. There was a carbon sludge on all the parts, which I cleaned. I assembled the compressor, pulled a vacuum, and charged with oil to within an inch of the shaft. (This shaft uses a dip ring about 4 inches in diameter). The compressor ran fine and pulled 2 inches more vacuum than before. I let it run for about 10 minutes under vacuum, and it started to tighten up again, although not as bad as before. I let it sit over night, and the next morning, it started right off. It acts to me as though an expansion is taking place. Do you think I had enough oil in the case?

ANSWER: From the description you have given me of your trouble, I would say that you have not succeeded in getting all the carbon deposit off the working parts of the compressor. I would suggest that you use steel wool, wire brushes or sandpaper to thoroughly scrub the parts while washing in gasoline or carbon tetrachloride. All working parts must be scrubbed or sanded until they are thoroughly clean and shiny. The compressor is then assembled and thoroughly dried or baked out, after which you should charge with 26 ounces of a good grade of oil. Since you do not know what the condition of the rest of the system is, I would suggest that you endeavor to wash it out with carbon tetrachloride, and dry under a vacuum before charging with SO_2.

MAJESTIC MODEL 345

QUESTION 231. I want to get some information on Majestic standard unit. It is a belt job, Model No. 345. Compressor and motor are separate. They also make a dry model with an expansion valve, No. 450. I would like information on this rotary compressor, and the check valve that is in the compressor. Is it a blade or cam type rotor, and how does it differ from the Norge or Frigidaire?

ANSWER: The check valve in the Majestic open-type unit is an integral part of the suction shut-off valve, located in the top of the compressor. This compressor is of the rotary single-vane type, similar in design, in some respects, to the Norge Rollator.

It differs primarily in that the roller is prevented from revolving by the single vane which is inserted in it.

Discharge of the gases is done through the center of the shaft, using ports rather than flapper valves.

Complete information on this unit may be obtained by referring to the September, 1934, issue—on page 5—of THE REFRIGERATION SERVICE ENGINEER.

TROUBLE WITH ICE CREAM CABINET

QUESTION 232. I have just started new on a job, and have a job of making an ice cream hardening cabinet (worked on by the man before me) work as it should.

This unit is in a drug store, and is a Liquid Carbonic outfit, originally consisting of two Frigidaire low side floats (9 lbs. sulphur each) pulled by a ½ ton water-cooled job. Original complaint was that unit would not hold temperature low enough in hot weather to keep the ice cream.

This unit was replaced with a ¾ ton air-cooled job (M & E 7½ lbs. SO_2). The brine was pumped out, tank washed out with hot water and cleaned as much as possible and pumped out. A new brine made 4 lbs. to the gallon and cooled to 35 degrees and placed in tank. It is supposed to be correctly charged with SO_2.

Now the lowest temperature I am able to obtain in No. 5 is 10 to 18 degrees in bottom of empty compartment. In Nos. 1, 2, 3 and 4, the temperature will range, on bottom, 4 degrees—on top around 10 to 12 degrees.

In checking the float, the line is frosted back as far I can see. This cabinet has marble sides and bottom, and appears to be well insulated. The motor and compressor have been blocked to run continuously, which it has been doing four or five days. The suction line shows no change in temperature next to unit (warm). The liquid line is slightly warm—I would say up to 1½ feet from the unit. The unit is operated with head pressure at about 73 lbs. and a 16-inch vacuum. The condenser is warm about one-third of the distance down from the top.

I first added about 4 lbs. of sulphur, which raised the suction pressure to about 13 or 14 inches, and No. 5 cabinet lowered its temperature to about 12 degrees. The rest of the cabinets stayed the same. After 6 to 8 hours, temperature and pressures returned to same again. Now, I took out about 5 lbs. SO_2 and they still hold the same temperature. This brine tank holds approximately 40 to 45 gallons of brine.

The druggist wants it to pull down to at least 0 degrees in all cabinets in order to hold it in the hottest weather.

Would appreciate any information immediately that you can give to solve the difficulty.

ANSWER: From the description you give of your trouble with the five compartment ice cream cabinet, I am inclined to believe your trouble is due to two things:

(1) Too great an oil blanket in the evaporator.

(2) To poor circulation of brine in the cabinet, or possibly to the need of two evaporators instead of one for this section.

The fact that the compressor is operating on a 16-inch vacuum, without obtaining a temperature lower than 10 degrees F. indicates too much oil in the system, or too heavy a blanket of oil in the evaporator. It should not be necessary to operate on less than 10 to 12 inches of vacuum to obtain a temperature of 0 degrees. After removing oil from the system (if you find this necessary) or changing the calibration of the float to reduce the oil blanket, it will probably be necessary to add more gas.

The wide difference in temperature between No. 5 compartment and the balance of the cabinet indicates poor circulation of the brine to this point. Your sketch shows that this compartment is the greatest distance from the evaporator, and that due to the uneven number of compartments, there is an unbalanced condition set up in this cabinet. Apparently the only means of correcting this trouble is by introducing some mechanical means of keeping the brine circulating, such as a motor-driven paddle or pump, or to add another evaporator between No. 3 and 4 compartments.

THERMOSTATIC VALVE TROUBLE

QUESTION 233. I am having trouble with a new Zer-O-Viz (a 6 ft. Grand Rapids Cabinet Co. ice cream display case). The owner wants the temperature 15 degrees below zero. I find that when the temperature gets to 10 or more below zero, there is no more response to the expansion valve. They are using a Detroit thermostatic expansion valve.

I find that if you run on 15 inches vacuum, it will hold at about 10 degrees below. If you run on 20 inches, it will hold about 15 degrees below, and the machine runs all the time. The expansion valve is almost wide open. The case will hold this for a day or so, and then start to warm up again. It is not moisture, for I have put two driers on. This is a methyl job. When the case starts to warm up, I withdraw the thermostatic bulb and hold it in my hand a few minutes, and the valve will open and then frost back to the machine. Could it be possible that when the liquid in the thermostat bulb reaches a temperature of 10 degrees below or more, it ceases boiling or expanding and causes the expansion valve to become inoperative? Would not a valve with bulb charged with a liquid with a lower boiling point remedy the cause? Please advise.

ANSWER: You are most certainly pulling a very low vacuum on this machine in order to reach a temperature of 15 degrees below zero with methyl. From your description, it is apparent that the coil is being starved of liquid, and by holding the thermostatic bulb in your hand until the suction line frosts, thus obtaining for a time your desired temperature, you are converting the coil temporarily to a flooded type by filling it up with liquid. The length of time required to pump this out governs the length of time you will maintain your temperature, and, of course, explains the gradual warming up.

Two possibilities present themselves here,

which would cause the trouble:

(1) If the valve is not charged with the same refrigerant as used in the system, or if in other words, the valve is charged with sulphur while you are using methyl in the system, the trouble you describe would possibly result. Check the marking on the valve to be sure you have a methyl valve.

(2) Most likely, the trouble is due, I believe, to a partially discharged power element. These valves are designed according to the Detroit Lubricator Co. to reach a temperature all the way down to 20 degrees below zero, or more, and they leave the factory in such condition to accomplish these temperatures. However, if through handling, etc., the valve has lost a part of its charge, it may reach a dead point in its operation at somewhat a higher temperature. The increase in its lower limit of temperature will vary with the amount of gas it loses.

I would suggest changing the valve, and if it is still under guarantee, send the old one back to the factory for inspection.

HOT GAS DEFROSTING

QUESTION 234. Sometime ago, I saw a diagram for a recommended hook-up for hot gas defrosting of low temperature coils. I cannot find this sketch, nor can I remember where I saw it. It cannot have been in the SERVICE ENGINEER as I have looked through most of my back copies, so I am wondering if you would be good enough to give me a diagram for such a hook-up.

ANSWER: While I have no information or illustrations at hand relative to the manner of making connections for a hot gas defrosting system, the following method has been found suitable. I believe it will perhaps be of value to you.

This method of defrosting can be used satisfactorily only on dry expansion coils. Due to the fact that the defrosting will be done in the most part by the customer, all valves used in the operation should be of the packless hand-wheel type.

For single coil installations, it is sufficient to install a by-pass between the top of the condenser and the suction line. The most simple and economical means would be to connect between the compressor discharge valve service port and the suction valve service port. A separate valve should be installed in the by-pass. Before using this means of defrosting, the compressor should be allowed to run for a sufficient length of time to insure a good quantity of hot gas in the condenser. The compressor should not be run during the defrosting with this hook-up, due to the high pressure resulting on the compressor seal. Shut off the suction valve (turn all the way in) before cracking the compressor discharge valve and opening the by-pass valve to permit the hot gases from the condenser to pass into the cooling coil.

Where hot gas defrosting is desired on multiple coil systems, the connections should be made as in Fig. 1. In this manner, it is possible to defrost one coil at a time and permit the machine to run during the operation. Defrosting in this manner would be comparatively fast since the coil being defrosted would temporarily act as a condenser for the gases pumped from the other coils in the system. The customer should be cautioned not to permit the machine to run too long with the by-pass open, since loading of the coil with liquid gas, and eventually slugging of liquid through the compressor, would result.

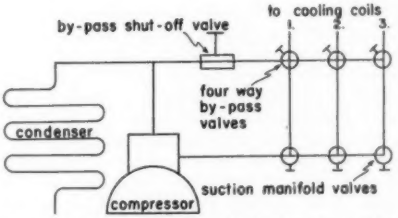

Fig. 1. Diagram showing the hookup for a Hot gas defrosting system on a multiple coil job.

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Leslie F. Hurner,
Missouri.

I have been a little slow in praising this publication, only through negligence. I wish to say now that, while it was very good when I first subscribed two years ago, it certainly has not stood still, but has steadily improved and every copy is read as thoroughly as time will permit, and a lot of good derived from the contents.

A. Romer,
New York.

Enclosed is my subscription to your very worthy trade magazine. You may commence same with the November issue.

Servicing the McClellan Refrigeration Unit

Fourth Article—Continued from November

By L. K. WRIGHT, M.E.

Charging Connections

A REDUCING coupling must be used on the end of the hose or pipe that is to be attached to the ammonia drum, for the standard openings in ammonia drums will be found to be ⅜ inch pipe thread. Therefore, either make use of a coupling ⅜ inch by ¼ inch and use a six inch nipple of ⅜ inch pipe in the end to be attached to the drum, or else make use of a pair of companion flanges, one of which has been tapped ⅜ inch while the other provided with a ¼ inch opening. The ⅜ inch nipple can be screwed directly into the flange. The latter method is widely used by ammonia installers who prefer to use the stronger and safer method, although the flexible hose method is the easier to work with, especially in cramped or small machine rooms.

Before connecting, the drum should be weighed on a platform scale, so that after charging the system the differences in weights before and after will show the amount of ammonia put into the system.

Where the pipe charging line is used the drum has to be manoeuvered into position, but where the hose is used the drum can be very easily placed or even moved, if desired. Where the hose is used the drum can be placed directly upon the scales and the amount of ammonia fed into the system at any time during the charging operation can be checked without removing the drum for weighing.

The ammonia drum should be arranged in a horizontal position slightly elevated from the floor, so that the valve can be easily manipulated. The bottom or end of the drum should then be elevated a few inches, by using a piece of wood or a brick under the bottom end, so that the liquid ammonia drains or flows to the valve end.

Connection to the charging valve flange (14) should be made carefully, using new gaskets and pulling up the companion flange bolts evenly.

Vacuum Test

After the air has been released from the system, close discharge valve (3) and purge valve (36) and start the machine, leaving valve (11) open. Operate machine until the low pressure gauge (20) shows no further decrease in pressure and a vacuum almost 30 inches has been obtained. Close valve (1) and stop machine for several minutes to make sure the system is tight under vacuum and external pressure; then start machine again and open valves (1) and (7), which will remove air from the charging hose.

When possible the installers would apply either a vacuum or pressure test just before leaving for the night and would examine the gauges for changes upon their arrival the next morning. A slight change would be expected, but an appreciable one would indicate a slight leak somewhere.

Removing Residual Air

To make certain that all air has been removed from the system, and there is always a small quantity which remains after attaining a high vacuum, open the valve on the ammonia drum slightly for not more than two seconds or until the hose shows pressure, in order to let a slight charge into the system.

Then close valve (11) as soon as the odor of ammonia is noticed and immediately open valve (3) to avoid high pressure on gauge (5). Now open valve (6) and test for ammonia leaks with sensitized paper. This paper, when wet with water, will turn red when exposed to ammonia fumes. Refer to Testing For Ammonia Leaks, for additional complete data on this paper and method of making same.

Charging

When the system has been made tight, close valve (6) to hold the ammonia in condenser and start machine running by opening the water inlet valve (17). Make cer-

tain that the cooling water is properly circulating by observing flow at the outlet to the sink or sewer. When starting for the first time it is best to open the pet cocks or to release the plugs, so that the condenser or compressor jacket will not be air bound through any air pockets.

Open charging valve on ammonia drum slightly, being careful not to exceed thirty pounds of pressure on the low pressure gauge (20). Then throttle the charging valve on the ammonia drum to ten pounds on gauge (20) and continue charging until the full charge allotted to the size of the machine has been transferred to the system, as shown by the decrease in weight of the ammonia drum.

Removing Ammonia Drum

If the charging has been proceeding with the drum upon a platform scale the operator will be able to tell when the proper charge has been pumped into the system. To remove the drum close the cylinder valve tightly and allow machine to run until the back pressure or low pressure gauge (20) shows a vacuum of 10 to 15 inches, after which the machine may be stopped.

Then close valve (7) and disconnect ammonia drum and hose. Take the weight of the drum to make sure that the correct amount of ammonia has been transferred to the system.

Ammonia Charges

The charge of ammonia for McClellan apparatus should be:

For a No. 2 unit..... 3 lbs.
For a No. 3 unit.....10 lbs.
For a No. 4 unit.....18 lbs.
For a No. 5 unit.....25 lbs.
For a No. 6 unit.....35 lbs.
For a No. 7 unit.....45 lbs.

The Expansion Valve

The expansion valve controls the pressure in the evaporator coils and automatically apportions the amount to the coils in the refrigerator. It is advantageous to "expand" at as high a pressure as possible to cause all coils to become frosted. The higher the back pressure the more efficient the compressor and the more liquid refrigerant vaporized per unit of time.

Expansion Valve Regulation

Close the expansion valve slightly by turning stem to the left (counter clockwise) and then open valve gradually. Start the machine and gradually adjust the expansion valve by turning stem to the left a turn at a time until gauge (20) shows a continuous pressure of 15 to 20 pounds with the machine operating.

Whenever machine is stopped the pressure will increase on gauge (20), due to the rise of temperature and expansion of ammonia in the evaporator coil; this does not mean that the expansion valve should be further adjusted, as the machine when started will restore the normal operating pressure of 15 to 20 pounds.

Expansion valve should be adjusted to carry a pressure not over 35 pounds. The formation of frost on the expansion coil or evaporator shows that the machine is operating properly. Should the suction pipe show heavy frost back to the compressor, indicating that valve is over-feeding or open too wide, close the expansion valve slightly by turning stem to the left (counter clockwise) using a valve key, until frost does not show outside of refrigerator. Do this slowly, not more than a half turn at a time and letting machine run for ten minutes after adjusting before checking the extent of the frost line on the new setting. The reduced pressure will be indicated by the low pressure gauge.

If the coils in the refrigerator are not frosted throughout their length, increase the amount of refrigerant to the coils, by opening expansion valve (turning clockwise) which will be indicated by a higher pressure on the low pressure gauge.

Emergency Expansion Valve

In case of emergency, where the expansion valve has become defective, refrigeration can be obtained by partly closing the valve installed near the expansion valve, after opening the extension valve fully. This method requires more attention, being non-automatic, but will give results temporarily.

Where a standard McClellan is found, there will be a valve before and after the expansion valve, the latter being set in place by flanges. By closing these valves, removing expansion valve and inserting a jumper pipe in place occupied by the expansion valve, the shut-off valves can be cracked open and allowed to act as needle expansion valves. Use both valves to get the proper back pressure.

The expansion valve can be opened and repaired. Then it can be installed, replacing the jumper piece. In this way the refrig-

erators were kept under refrigeration while the operator was repairing the valve.

Cleaning Expansion Valve

Sometimes a particle of dirt will cause the expansion valve to stick and get out of adjustment. To clean such a valve, first close the liquid inlet valve to the expansion valve. Turn the expansion valve stem down as far as it will go, counting the number of turns. Operate machine until back pressure has been reduced to about ten inches of vacuum. With machine running and the proper vacuum secured, open the liquid inlet valve as quickly as possible. This will allow a rush of high pressure liquid through the expansion valve, which generally carries along the dirt. Repeat this several times. Then return expansion valve to original setting. Open liquid inlet valve wide.

Gauge Pressures

The high pressure shown on gauge (5) in Figs. 5 and 6 will vary in proportion to the temperatures of in-going cooling water, while the low pressure gauge (20) will be governed largely by the amount of evaporator coilage in the installation, the refrigeration load and the temperature carried.

The high pressure gauge should register between 80 to 210, averaging 140 to 160 pounds, while the low pressure gauge will vary from 10 to 35 pounds; usually 20 to 25 for refrigerators.

Source of Water

Water is ordinarily supplied from lakes, rivers, springs, or wells. Lake and river water will be found to vary considerably in temperature at different times of the year. Spring and well water will be of rather uniform temperature at all times of the year and will be considerably cooler in the summer months than lake or river water.

The amount of water required to properly condense the ammonia vapor depends upon the temperature of the water entering the machine. Water that is cold when it reaches the machine will give the best results and the amount used will be much less than if warmer water must be used. It is obvious that more water must flow through the machine when warm water is used and that the head pressure will be somewhat higher than where cold water is available.

Where electricity is expensive and water cheap, use more water so as to reduce head pressure and electric consumption. Where the reverse is the case, use less water.

Gauge Hand Lifter

By L. K. WRIGHT, M.E.

THE gauge is probably one of the major adjuncts of any installer's or service man's tool kit. Carried in rather loose fashion such gauges meet with strenuous service, much more than shop or laboratory gauges. It is no wonder that they require frequent checking or replacement.

In order to inspect the gauge mechanism to ascertain Bourdon tube damage, hair spring trouble, or to find a loose toggle, it is necessary to lift off the face of the gauge. First, the bezel and glass or composition crystal must be removed. Then the gauge hand should be lifted off the spindle, after which the screws, usually but two in small gauges, may be removed. The face plate can then be dropped out.

The removal of the gauge hand can be accomplished by gripping it tightly with a pair of pliers and pulling the hand straight off the spindle. The gauge is best held in a vise. If too much pressure is exerted by the jaws of the pliers the ring segment or

FIG. 1. GAUGE HAND LIFTER.

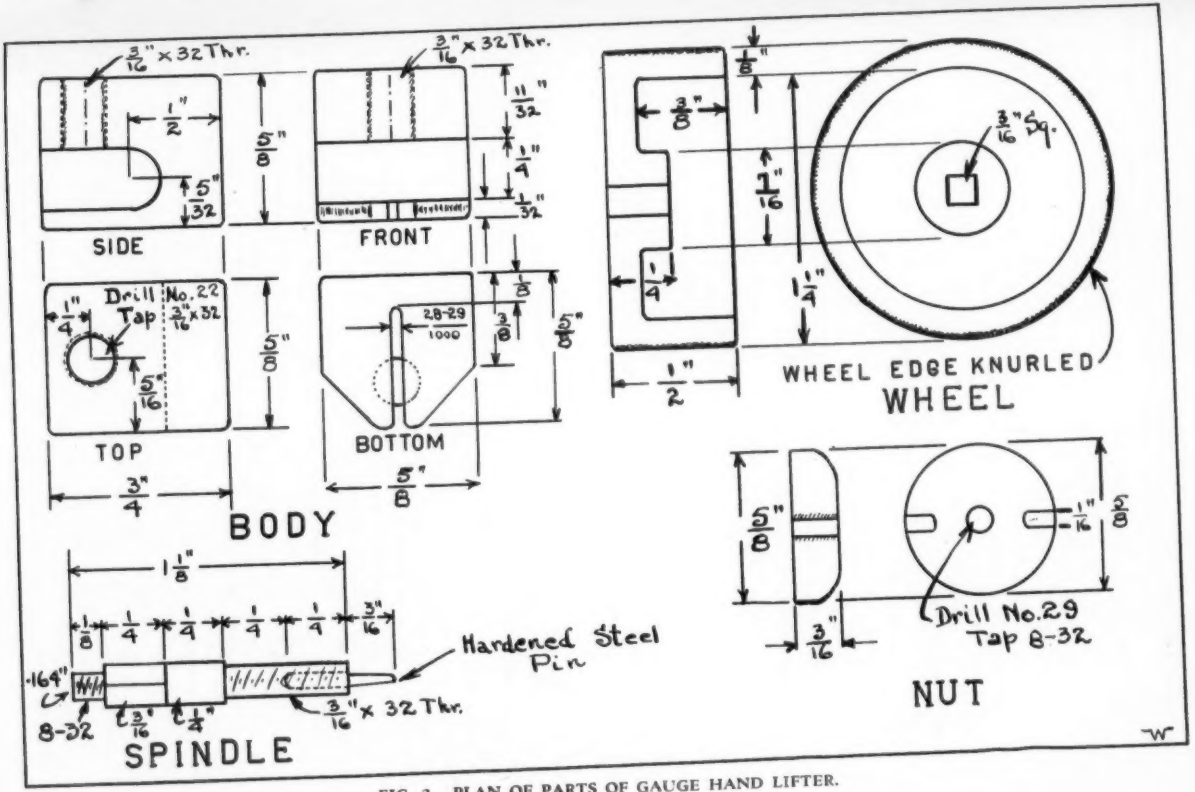

FIG. 2. PLAN OF PARTS OF GAUGE HAND LIFTER.

center of hand may be crushed or deformed. Other than a straight pull will bend the shaft and it is a difficult thing to get it back into correct line.

There are commercial gauge hand lifters to be obtained from dealers in engineers' tools, but they will be found to be somewhat expensive. The following design is of such simple nature that no machine work is required. The gauge hand lifter shown in Fig. 1 was constructed by the use of hand tools only, except for the thumb wheel.

Use of such a device will lift the hand without damage to spindle, hand or face. Where gauges are used the lifter will be found to be a valuable aid to speedy service and will eliminate damaging of shaft or hand.

Construction Data

The body section is best made of a block of soft steel, although cast iron, brass or bronze will also serve. A quarter-inch hole is drilled through from side to side and then a piece is hack-sawed out, leaving the round bottomed slot shown in the front and side views of the body, given in Fig. II.

Next use a No. 22 drill; and then tap the hole 3/16 inch x 32 thread. Take care hole is in perfect line as the tiny ram must sit directly over the gauge shaft for best results.

The underside of the body can then be slit with a hack saw. Take a new blade and break off an inch or so from the end. Use the blade without a frame and finish the channel with a fine file.

The bottom side may then be relieved at the two corners, as can be seen in Fig. I and in the bottom view given in Fig. II. Round off all corners, especially on the bottom, and then polish with fine emery cloth or paper. Edges and face of the underside or bottom must be smooth so that the gauge face will not be marred by scratches.

For the spindle, use a piece of quarter inch soft steel, brass or bronze rod. Where a lathe or even a chuck on a motor is available, the spindle can be turned out in a few minutes. A careful worker, however, can file out the spindle, without recourse to a lathe. The spindle shown in the reproduction of a photograph of the lifter was entirely handmade.

If desired, the 8/32 thread can be eliminated from the spindle and the 3/16 inch square section drilled and tapped to take a machine screw.

Drill the spindle end with the long thread (3/16" x 32 thr.) to take a phonograph needle, the sharp end of which should be ground down slightly and rounded over. The needle end must be small enough to enter the ring on the head; therefore, do not grind off the end to any great extent.

The thumb wheel can usually be obtained from any supply house or taken from a small valve. It need not be of any special diameter or design. The wheel shown in the illustrations, with its wide knurled edge, is easy to apply pressure to. It can be easily turned out by any machinist. Soft steel or brass may be used for the wheel.

A nut is shown in the sketch, this being required to hold the wheel on the spindle. It can be slotted as shown or may be standard machine nut of correct size. If the spindle is drilled this nut will not be required. Instead, a short machine screw is then made use of to hold the wheel on the spindle.

In drilling the hole in the spindle end to take the hardened steel pin, care must be exercised to have it concentric, otherwise the pin will wobble and will not apply pressure properly.

Assembly of the lifter is extremely simple and requires no comment.

How to Use It

To use the lifter have spindle unscrewed so that lifter can be slipped under the ring on the hand which grips the gauge shaft. The spindle is screwed down so that the steel pin centers on the gauge shaft. By turning the knurled wheel the hand will be lifted off without bending or damage to other parts of the gauge.

In many cases continued vibration loosens the hand so the gauge reads incorrectly. Check the mechanism and make sure the Bourdon tube is not distorted and that all linkage is in proper order. Use the lifter to take off the hand, so that when reassembly is made there will be no trouble encountered due to twisted shaft, pinched or broken hands.

To replace a hand, set it in place loosely and have it indicate 0 lbs. On some compound gauges this is the center of the blank space between 1 lb. and 1 inch. Give the ring of the hand a sharp tap with light hammer, applying pressure in a line straight with the shaft.

Keep oil away from the lifter. Have clean hands when working on gauges, as oil or dirt will show up immediately on the white gauge faces and it will be found impossible to clean them.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

NEW CHAPTER ORGANIZED AT OMAHA, NEBRASKA

THE organization of a local chapter was sponsored by the United Supply Company and the organization meeting was held at the Elks Club, on November 26th. Mr. H. T. McDermott, national secretary, was introduced and he explained to those present the benefits of the Society, its aims and purposes.

Temporary officers were elected to hold office until a charter is granted, at which time permanent officers will be elected. Mr. C. J. Doyle, Omaha Refrigeration Co., was elected temporary chairman; Ralph C. Walbridge, Acme Refrigeration Co., was elected temporary treasurer; and T. R. Cherry, Cherry Refrigeration Co., was elected temporary secretary.

The temporary chairman appointed a Membership Committee to consist of the officers and D. W. Schuneman of Major Appliance Co., Mr. Frank Williams, All Makes Refrigeration, and E. C. Hamilton of A. M. Carney Co.

Refreshments were provided by the sponsor, United Supply Company, after the meeting.

The next meeting is to be held December 2nd, at which meeting the charter will be closed and forwarded to the National Office.

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KANSAS CITY CHAPTER

Meeting of November 23, 1937

By **S. A. LEITNER,** *Acting-Secretary*

MEETING was held at the Commonwealth Hotel and was called to order by President H. L. Green.

Four visitors were present at this meeting: Mr. Roes, Mr. Tabor, Mr. Hincke, and Mr. Downs.

The membership committeee reported no action on the application of Mr. Chas. W. Stein, due to the investigation not being complete.

The application of Mr. Geo. W. Baile was approved and submitted by the committee, with recommendation that applicant be accepted as an associate member. President Green placed same to a vote by the members, resulting in a unanimous vote for acceptance. As Mr. Baile was not present at this meeting, he was notified by mail of the action taken, and asked to attend the next meeting to be held December 14th, at which time he will be accorded the usual greetings.

President Green then called for remarks for the good and welfare of the chapter, which resulted in quite a lengthy discussion, the subject being "attendance at meetings." At the meeting on November 9th, the secretary was instructed to send out a special letter to all members asking for their support and regular attendance, which was done. Suggestions by Messrs. Roberts, Ryan and Paris, resulted in the following motion to be made by Roberts, and seconded by Paris, "That the secretary draft a questionnaire to be distributed to a special committee, to be named by the President, together with a list of names and addresses of non-attending members, and each member of this committee to contact personally the number of members assigned to him to determine the reason for non-attendance, and to note the remarks made on the questionnaire, and these in turn would be analyzed, and the results used to chart our next step in pro-

moting an active interest in future meetings."

The questions as suggested for this questionnaire are as follows:

1. What can be done to make or create your interest?
2. What is your idea of an educational program—or, do you want one?
3. Are you interested in what other servicemen are doing?
4. Are you interested in what the manufacturer has to show, or manufactures?
5. Are you interested in future legislation and municipal codes, pertaining to your profession?
6. What are your grievances towards this organization?

The motion was then brought to a vote, and duly passed. President Green appointed the following members to act on this special committee: Messrs. Roberts, Bloesser, Sullivan, Ryan, Paris, Thompson, Anderson, Von Demfange and Fromholtz.

The proposed changes and amendments to the constitution and by-laws were next read and discussed, which will be voted on at the annual meeting to be held the first Tuesday in January.

President Green instructed the Secretary and Treasurer to prepare their annual reports to be presented at the annual meeting in January.

A nominating committee of three was appointed by the President to meet with the officers and directors at an early date prior to election. Members appointed to this committee were: Messrs. Roberts, Ryan and Thompson.

It was proposed by the members present that the chapter serve refreshments at the next meeting after the business sesssion, and a collection was taken up to defray the expense, relieving the chapter treasury of same.

MISSISSIPPI VALLEY CHAPTER

Meeting of November 26, 1937

By **E. L. BENGSTON,** *Secretary*
116 E. First St., Davenport, Iowa

DUE to the absence of both the President and the Vice-President the motion was made from the floor by Mr. A. H. Russ, seconded by Mr. O. Balke, that Mr. E. J. Ford conduct the meeting. Roll call was taken and the minutes of the previous meeting, as well as the Treasurer's Report, were read by Mr. E. L. Bengston. Mr. Balke made the motion, seconded by Mr. Eldridge, that both reports be accepted as read and placed on file.

The Entertainment Committee advised the members regarding the Annual Banquet at which the ladies are to be present. The motion was made by Mr. Willetts and seconded by Mr. E. E. Eldridge that the banquet be held at the Hollywood Supper Club in Rock Island, Ill., on Tuesday evening, December 14th. The motion was made by Mr. C. D. Kaufman, seconded by Mr. Eldridge, that each member be assessed 50c per plate for himself and his wife or lady friend, the balance of the expenses to be paid from the treasury.

As this was the question box meeting there were a lot of questions asked and answered with quite a lengthy discussion following. One of the questions submitted was "Why Does Meat Turn White in a Double Duty Display Case?" This display case in question was in use only between eight and ten months. Ground pork and lunch meats seem to be the type meat that turned white. Beef was not so bad. The Secretary was instructed to write to Mr. Geo. H. Clark, Chairman of the National Educational Board regarding this matter to see if he could throw any light on this question.

THE "CONTRIBS COLYUM"

By **THE KINGFISH**

WE are gradually recuperating from the strain of the last convention.

Winter is here—it is 10 degrees above zero —and we are now preparing for a number of overhauling jobs which are to be done this winter.

We have spent last week going around and checking up on our guarantee jobs from the National Manufacturers—oiled motors, tightened belts, cleaned water valves and condensers, adjusted controls for winter temperatures, cleaned the machines, etc., etc.

We have also used up some black and grey paint touching up the bare spots on the compressors, so they won't look too shabby.

Our collection of dirty strainers and wet dryers is piling up in the shop and we can spend some time getting these in shape for next year.

We have resolved to attend all the R.S.E.S. meetings and to take an active part, because we read the small verses in the

November issue of the R.S.E. about being more than just a name on the roster. Incidentally, that is something for all of us to think about.

While talking about resolutions—we have made up some which we think are very good, and we shall present them in the next issue of the magazine.

Had a letter from our National Secretary McDermott and he tells us that he attended two more conventions immediately after our own convention. What a man!

He also tells us that he was in Omaha, Nebraska, and there established the first new chapter after our convention. Here is a cordial welcome to the boys of Omaha.

E. A. Plesskott of St. Louis drops us a line telling us about things which may affect the success of the Society in the future. Plesskott is one of the few men in the organization on whom we can always depend both for active work and correspondence.

I wonder if you have realized how far flung our association really is. Sit down and take a look in the membership register in the new year-book. There are men from near and far, and there may be someone near you whom you may like to get acquainted with.

We are wondering where our next convention will be. Pittsburgh is a busy City with lots of things to offer and located in the heart of the beautiful Allegheny mountains, and Buffalo—well everybody at once thinks of Fedders Manufacturing Co. and Niagara Falls, and we know the Falls will be a big attraction for the ladies.

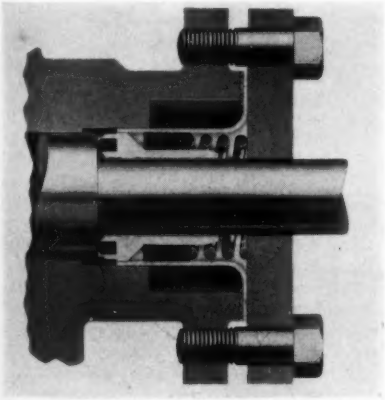
DAYTON CHAPTER

Meeting of November 5, 1937

By **GEO. O. SNYDER,** *Secretary*
R. R. 5, Box 224, Dayton, Ohio

PRESIDENT E. O. BOWMAN called the meeting to order; followed by reading of October 22nd meeting minutes.

As a committee had been elected to inves-



A Frictionless Face Seals Against the Shaft Collar

⅛ Inch No. 20 Seal $3.85, less generous discounts. Fits Refrigerator Compressors with ⅜" Shafts

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SYNTRON

SHAFT SEALS

Stop Leaking Shafts

for Once and for All

▼

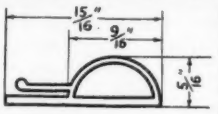
Life tests in actual service have proven their ability to effectively seal worn and scored shafts, as well as new shafts, against vacuum and up to 300 lb. pressures.

SELF SEATING—SELF CENTERING—SELF LUBRICATING

Order from your Jobber or Direct from Us

SYNTRON CO., THOMAS BLVD., HOMER CITY, PA.

Insist on JARROW Replacements



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● The gasket illustrated was made especially for Apex replacement. It fits. All JARROW gaskets are built to manufacturer's specifications.

JARROW PRODUCTS CORPORATION
420 N. LaSalle St., Chicago, Ill.

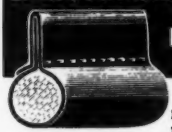
Consider BLYTHE *your Stock Room*

Immediately available to supply your refrigeration and air conditioning supplies — wholesale only.

PARTS A complete line of standard parts carried in stock at all times
TOOLS Everything you need to do a better and faster repair job
SUPPLIES The best there is on the market. Write for catalog

H. W. BLYTHE CO.
2334 S. Michigan Ave., Chicago

DENNIS GASKETS
FOR ALL MAKES REFRIGERATOR DOORS



A complete line of rubber - coated, packed Gaskets and extruded rubber Gaskets that last longer —retain higher efficiency—because made of finest materials and workmanship. Write for free samples, giving your jobber's name and address.

W. J. DENNIS & CO.
2110-20 WEST LAKE ST. ··· CHICAGO

REPLACEMENT GASKETS FOR ALL MAKES

Metallic Gaskets that hold regardless of what the refrigerant may be and will not shed particles of material to clog up important working parts in a machine.

Send for catalog listing many "orphans" not available elsewhere.

CHICAGO-WILCOX MFG. CO.
7701 S. AVALON AVE., CHICAGO, ILL.

tigate various halls for the holding of our meetings, they submitted their report and after some discussion it was decided to meet in the future in Room 310, Dayton Industries Bldg.

All prospective members' names are to be given to the Secretary, who will send out invitations for the next meeting.

Meeting of November 19, 1937

Meeting called to order by President E. O. Bowman at the Dayton Industries Building.

Mr. T. C. Bickel gave a long and interesting talk about the Chicago convention. Mr. C. L. Price of Sidney, Ohio, who had attended the convention, also gave an interesting talk.

Mr. Johnson of the Johnson Manufacturing Co. of Chicago spent the evening with the chapter and explained the various uses of a soldering flux manufactured by his company.

A motion was made by Mr. R. Brown, seconded by H. F. Pottenger, to accept Mr. J. L. Homan's suggestion to hold our meetings in his Air Cool Institute School Room at 68 Stratford Avenue, every other Wednesday night, free of charge.

Therefore, a motion was made and passed to hold regular meetings on Wednesdays instead of Fridays, at the above mentioned school room.

TRI-COUNTY CHAPTER

Meeting of November 15, 1937

By **PAUL SEIFRID,** *Acting-Secretary*
614 Hinman St., Aurora, Ill.

AFTER a dinner in the dining room of the Woodruff Hotel, the regular business meeting came to order. The meeting was held in Joliet, Illinois.

The delegate and alternate to the convention gave their reports of the convention.

The resolution appearing in the last issue of the R.S.E. was read in the revised form in which it was read on the convention floor by Mr. Willis Stafford.

A motion was made and carried that a collection be taken up by Mr. Riechenbacker for the bouquet for B. V. Clark.

Mr. White made a suggestion that our meetings be held only monthly rather than semi-monthly. This was thoroughly discussed and Mr. York set it in the form of a motion which was seconded by Mr. Metcalf. The meetings are to be held the second Monday of each month, in the following rotation: Elgin, Aurora, Joliet.

A motion was made by Willis Stafford

that the sergeant-at-arms must take a roll call at every meeting. Mr. White seconded the motion.

Mr. Stafford, chairman of the Educational Committee, asked Mr. W. F. Hauber, of Automatic Heating and Cooling Co., to introduce the speaker of the evening, Mr. Carrol, chief engineer of Automatic Products, who spoke on "Thermostatic Expansion Valves."

The proposal of having a state chapter was brought up by Mr. Stafford, and was discussed by the members. It was decided that the next meeting be held with an invitation to the Chicago and Rockford chapters to discuss this between the three chapters.

CAPITAL CITY CHAPTER

Meeting of September 22, 1937

By M. H. HAMILTON, *Secretary*
1522 Isherwood St., N.E., Washington, D. C.

PRESIDENT N. MATHESON called the meeting to order, after which Secretary M. H. Hamilton read the minutes of the previous meeting as well as a letter from National Secretary H. T. McDermott.

The Educational Committee reported they had made arrangements with the Detroit Lubricator Company to have a representative present at our meeting of October 18th, and to send invitations to all members for this meeting.

President N. Matheson gave a talk on the proposed electrical code in Prince George County, Maryland. He stated he went to see Mr. Connie in Marlborough, Md., about this code regarding the servicing and installation and how it would effect the refrigeration men living in the District of Columbia and doing work in the state of Maryland. It requires a master's electrical license to do installation work. No license for servicing refrigeration equipment is needed.

Secretary Hamilton was instructed to write Mr. Connie and ask him to supply us with rules and regulations governing this code as to what refrigeration service engineers can do and cannot do, and also tell Mr. Connie that the Capital City Chapter would cooperate with him.

Meeting of October 13, 1937

A special meeting of the Chapter was called by President N. Matheson at Joppa

FOR COMMERCIAL USE

Mills Compressors

★ Mills Novelty Company
4100 Fullerton Avenue, Chicago, Illinois

SOLD ONLY THROUGH SERVICEMEN, DEALERS, AND DISTRIBUTORS

Lodge, 4209 9th St., N.W., with sixty-five members and visitors present.

Mr. Matheson gave a short talk on the purpose of the meeting and the purposes and objects of the R.S.E.S.

President Matheson introduced Mr. Roy Stevens of the Detroit Lubricator Company. Mr. Stevens gave a talk on Detroit Valves. He drew diagrams on the blackboard showing just what happens in an evaporator when using an automatic expansion valve and explained thoroughly the operation and how to test thermostatic expansion valves. Questions were asked from the floor, which Mr. Stevens willingly answered.

The meeting was then turned over to President Matheson, who thanked Mr. Stevens for the evening's entertainment. At President Matheson's request, Mr. E. J. Uhthoff gave a very fine talk on the objects and benefits derived by belonging to the Society. He then asked the visitors present if they would write to the Secretary to have their names put on our mailing list, so they can be notified when we have our educational meetings.

PITTSBURGH CHAPTER

Meeting of October 8, 1937

By F. V. GOLITZ, *Secretary*
1109 Pemberton St., Pittsburgh, Pa.

THE regular meeting of the Pittsburgh Chapter was held on Friday, October 8, in the Commonwealth Building, President J. Kirch presiding. About forty members and visitors were in attendance.

The meeting opened with a discussion of the feasibility of organizing a campaign to bring the 1938 convention to Pittsburgh. Mr. C. O. McCauley led the discussion. A motion by Mr. McCauley and seconded by Mr. N. Wagener that a campaign be organized to bring the 1938 convention to Pittsburgh.

Correspondence regarding the convention was read by Mr. Kirch. It was moved by Mr. V. C. Waight and seconded by Mr. Metcalfe that the election of delegates be held and that the member receiving the highest number of votes be declared delegate and the second highest be declared alternate. Motion carried. The result of the election was for delegate E. V. Black and alternate N. D. Wagener.

It was moved by Mr. Barbagallo and seconded by Mr. Wagener that the train fare to and from the convention be paid to the delegate. Motion carried.

The Educational Feature was a talk by Mr. H. S. McCloud on "Figuring Heat Load." Mr. McCloud's lecture was brief due to the lack of time. It was moved by Mr. Wagener and seconded by Mr. Black that Mr. McCloud continue his lecture at the next meeting and that the Secretary purchase materials and construct a suitable blackboard. Motion carried.

Mr. Kirch appointed a Nominating Committee composed of W. H. Barnes, G. W. Metcalfe, and L. R. Koontz.

Mr. Wagener was thanked for the Temperature Pressure Charts to be distributed to the members. It was moved by Mr. Ross and seconded by Mr. Black that the chapter print a number of these charts for publicity use, the expense of printing to be paid by the chapter. Motion carried.

Meeting of November 12, 1937

The meeting was held Friday, November 12, in the Commonwealth Building, with Mr. John Kirch presiding.

The Nominating Committee reported the following nominations:

President: John Kirch and E. V. Black.
Vice-President: V. C. Waight.
Secretary-Treasurer: F. V. Golitz.
Board of Directors: J. C. Hipps, C. A. Claus and John Barbagallo.

Additional nominations are to be made from the floor at the election meeting to be held on December 10th.

Mr. Kirch reported that due to the illness of E. V. Black the report on the Chicago convention would be postponed until the next meeting.

Mr. Kirch appointed the following as an Auditing Committee: S. A. Ricci, L. R. Koontz and M. L. Robinson.

It was moved by Mr. Waight and seconded by Mr. McCauley that the offices of Secretary and Treasurer be combined in order to save duplication of the work; motion carried.

The advisability of sponsoring a Ladies' Auxiliary was again discussed and Mr. Kirch delegated Mr. Barbagallo to devise ways and means for organizing the ladies.

"Chieftain" Quality Built Compressors and Condensing Units

are designed to give you many years of quiet, efficient and trouble free service by Engineers who have been serving the refrigeration industry for the last fourteen years.

They have again "scored a hit" with a new "V" type four cylinder compressor which is designed for use with ½ to 1 HP motors. All of the advanced features that have proven so successful in "Chieftain" household and light commercial units are now incorporated in this new four cylinder model.

Mechanical improvements include, force feed lubrication to piston pin and connecting rod bearings, positive alignment of cylinder bores with main bearings by casting cylinders and crankcase in one piece. Adjustable suction shut-off valve, interchangeable parts with single and twin cylinder models. All compressor parts are machined to precision limits on up to date equipment and assembled in glass enclosed rooms where only filtered, dust free air is admitted.

Write for our latest descriptive catalog

TECUMSEH PRODUCTS CO., Refrigeration Division TECUMSEH, MICH.

WORLD-WIDE DISTRIBUTION

Prompt Delivery To All Points

World-wide demand for the famous refrigerants, ESOTOO and V-METH-L, led to the creation of a globe-covering network of distribution points. They are rushed to you by every means known to modern science. Pure, reliably uniform, and dry as the highest technical skill can make them, it is no wonder that these quality products are the choice of an increasing number of experts in the refrigerating service field.

EXTRA DRY ESOTOO and V-METH-L

PRODUCTS OF VIRGINIA SMELTING CO.
WEST NORFOLK, VA

ST. LOUIS CHAPTER

Meeting of October 28, 1937

By E. A. PLESSKOTT, *Secretary*
2145 67th St., St. Louis, Mo.

THE regular meeting of St. Louis Chapter held Thursday, October 28, at the German House was called to order by President Gygax at 8:30 p.m.

The minutes of the previous meeting were read and approved. Mr. Paul E. Ruthledge of the Utilities Engineering Institute of Chicago was introduced and gave an interesting talk on what his school offers to the man interested in refrigeration as a means of livelihood.

Our next meeting was to be addressed by an engineer of the R. & H. Chemicals Co., on methyl chloride, and the meeting of November 25th was ordered postponed as this would have fallen on Thanksgiving.

The meeting of December 9th has been set aside as "Hinsdale Nite." Mr. Geo. F. Miller, Director of Sales for the Hinsdale Mfg. Co. of Chicago, will show a complete line of their refrigeration tools. They have graciously promised us several attendance prizes for this night.

Mr. Wilkerson supplied the officers with some timely suggestions and constructive criticisms.

Meeting of November 11, 1937

The regular meeting of the Chapter held at the German House on Thursday, November 11th, was called to order by President E. Gygax at 8:30 p.m.

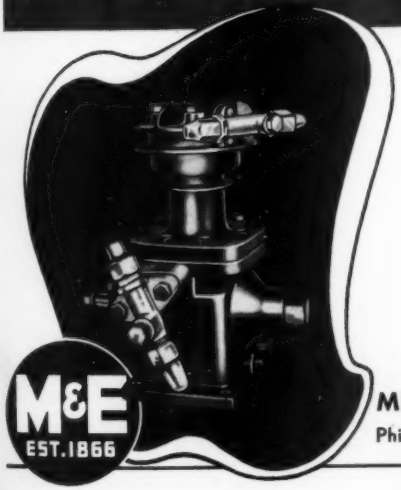
Due to a misunderstanding on speaker arrangements, Mr. Gygax had contacted Mr. Walter Niestrath, local representative of the Marsh Gauge Co. for this meeting, who gave us a most interesting talk on gauges, thermometers and recording instruments. He particularly stressed his Company's line of refrigeration gauges with the zero re-set feature and explained fully why this is a positive and accurate method of gauge recalibration.

The direct reading thermometer with long capillary was next presented, and some of its many and varied uses explained. Questions and answers consumed the balance of his allotted time.

Mr. A. C. Scholl, Technical Examiner of the U.S. Department of Labor, Division of Standards and Research, was introduced by Secretary Plesskott. Mr. Scholl explained his purpose of meeting with us this evening; it being his job to get up a series of test questions for the examination of men claim-

The exhibit of Snap-on tools displayed at the recent annual convention in Chicago. Unfortunately the picture arrived too late for the November issue in which other exhibits appeared.

BARE COMPRESSORS and COMPLETE UNITS



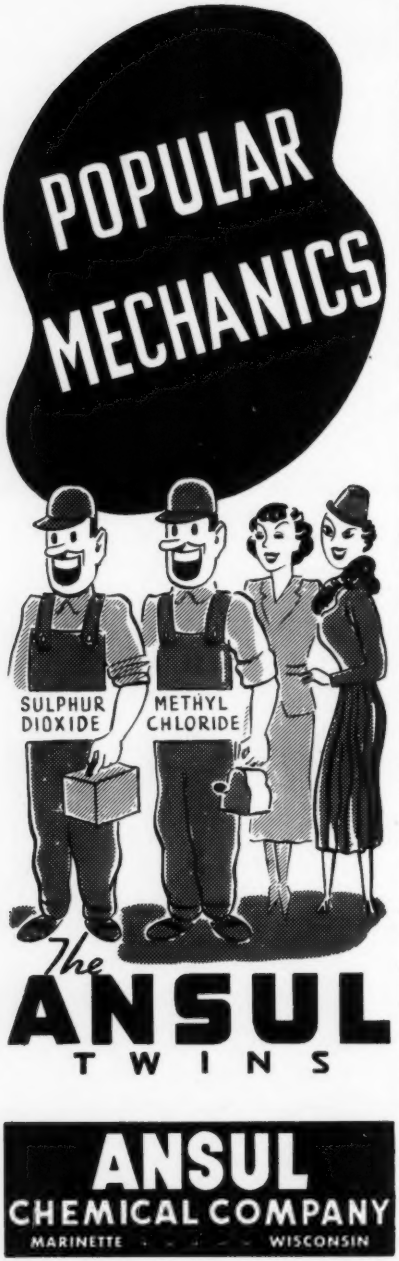
All types for service replacement and new installations . . . One, two and four cylinder models from ¼ h.p. to 20 h.p. . . . For Sulphur Dioxide, Methyl Chloride or Freon.

Write for new catalog—a valuable reference for assemblers and service companies.

M&E EST. 1866

MERCHANT & EVANS COMPANY

Philadelphia, Pa., U.S.A., Plant at Lancaster, Pa.



ing to be refrigeration service men, and he felt that no other men were better qualified than we to render assistance in this undertaking.

The Secretary stressed the reason for giving Mr. Scholl every assistance possible as the reputation of the service engineer in general might be judged on the basis of this research. Several members signified their intention of sending in questions to Mr. Scholl, who, in turn, thanked the membership for the privilege of having met with them and for their generous offer of help.

The meeting of Thursday, Nov. 25th, was postponed. Attention was also called to our meeting of Thursday, December 9th, which was to be set aside as "Hinsdale Nite" with the promise of several attendance prizes.

* * *

REFRIGERATIVE SUPPLY, INC., XMAS REMINDER

TO all its regular customers, the Refrigerative Supply, Inc., of Seattle, is sending a rather novel Christmas reminder. As a gift, they send a short, pocket-size, but strong, durable 5/16-inch screw driver. Enclosed with it is a greeting card, on the inside pages of which appears the following poem:

What Service Men Are Made Of

I want to tell you a story,
A story I have heard;
You may think it all a fable,
But it's gospel, every word.

The Good Lord took a blacksmith
And a tinker, and a chap
Who used to be an ice man—
Took him off a lady's lap.

A grease monkey and a plumber,
An "electric" engineer.
A steam fitter and his helper
And a man who smelled of beer.

And he mixed 'em all together
With a grain of salt or two
And he set 'em in the shadows
And let the mixture brew.

Then he ran it through a filter
And screened it through a grid;
He seasoned it with "menthol,"
And lifted off the lid.

He moulded it and twisted it

And shaped it here and there,
Then took it out and looked at it
And set it on a chair.

He took some sulphur from a tank
And shot it full of juice;
But when it didn't seem to care
The Lord said, "What's the use?

"Here I've tried to make a genius
By a very novel plan,
But the darn thing ain't no genius
It's just a service man."

MUELLER BRASS CO. NEW IMPROVED DEHYDRATOR

WHEN a dehydrator is in operation, there is a tendency for small particles of its drying agent to lodge on the face of the outlet filter. This condition will increase until the line is greatly restricted through clogging.

There are many different dehydrating agents used in refrigeration systems, and their fundamental use as such is the removal of moisture. Finer particles are continually breaking away from the larger crystals of the dehydrating agent with which the unit was originally charged.

Even those dehydrants which are less susceptible to this breaking off action carry with them particles which become dislodged or worked out through abrasion, as there is more or less continuous movement going on while the dehydrant is in service.

Restriction results in pressure drop, causing some evaporation of the liquid into gas. This mixture of liquid and gas causes trouble at the expansion valve. A decided temperature drop at the outlet of the dehydrator is an indication to the service man of this trouble.

The new improved dehydrator is designed to correct this condition. The cone-shaped screen, filled with pure wool, directs the fine particles of the drying agent to the outside of the base of the cone. Any particles that get through the screen will lodge in the wool filler without clogging, leaving the center free for the passage of the refrigerant.

Mueller Brass Co. has also added to its refrigeration line two new valves for relief applications. One is an angle receiver valve

"MUST" EQUIPMENT ON EVERY SERVICE JOB

No bother—light to carry—on and off in a jiffy; face piece and head band are adjustable.

CESCO HEALTHGUARD FUME KIT

Comes with cartridges for Ammonia, Sulphur Dioxide and Methyl Chloride. Saves eyes, nose, throat and lungs from injury. Write for details.

CHICAGO EYE SHIELD CO.
2341 Warren Blvd. Chicago

with a bypass outlet threaded to take a fusible union or relief valve. By using this type of receiver valve it is not necessary to braze a separate fitting into the receiver for a relief outlet.

Another new valve is an angle relief valve which conforms to the code requirements of many cities. Positive in action this valve opens instantaneously at the pressure for which it is set and closes automatically as the pressure drops below the setting. The angle type construction permits emergency servicing without removing the valve from the system.

Fully descriptive literature of these new products will be mailed on request to Mueller Brass Co., Port Huron, Michigan.

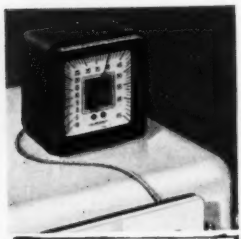
\$ \$ \$

PERSONNEL CHANGES IN KOLD-HOLD MFG. CO.

IN June of this year Mr. James R. Tranter, who is also President and General Manager of the Hill-Diesel Engine Company of Lansing, Michigan, purchased the controlling interest in the Kold-Hold Manufacturing Company which is known throughout the trade as the pioneer, developer and leading producer of the hold-over type of truck refrigeration and ice cream cabinet conversion units.

JAMES R. TRANTER.

Since taking over the business Mr. Tranter has made an intensive study of the firm's manufacturing and merchandising methods as well as the requirements of users and has recently assumed active management of the company's affairs—superseding Mr. W. G. Farnsworth as general manager.



The handiest tool in the kit—

For all service jobs—checking switch action, answering complaints of too high or too low temperatures—checking brine tanks and vessels, servicing household refrigerators, commercial boxes, cold storage jobs. Also valuable in selling refrigerators, making surveys of cooling jobs, etc.

No More Guess-Work

when you use the - - -

MARSH "Serviceman"

REFRIGERATION SERVICE THERMOMETER

More and more it is becoming apparent to service men and distributors that the only correct and convincing reading of refrigerator temperature is made *under actual working conditions with the refrigeralor closed.* The new Marsh "Serviceman" has been built to supply this need for a compact, versatile service thermometer, sturdy and accurate, yet modestly priced with plenty of capillary tubing for reaching any desired point of testing. Its clear dial with big divisions is easily read. There is no guess work as when an ordinary pocket thermometer is used. You *know*—and so does the customer!

"Recalibrator" assures lasting accuracy

The "Serviceman" is guaranteed accurate within *one degree.* If it is knocked out of adjustment, you simply place the bulb in cracked ice and water, and turn the "Recalibrator" screw until the pointer records 32°. It will then be right at *every point on the dial.* This is not the conventional pointer resetting device which is always subject to error. It is a real re-calibration—an exclusive feature of Marsh Instruments. Modern facilities and volume production make it possible to sell this finely built, precision instrument (in ranges of —10° to +65°F, or −10° to +100°F) at a dealers net price of **$5.00** (Minus 20° temperature range at slightly higher price.) F.O.B. Factory

WRITE FOR NEW REFRIGERATION CATALOG

JAS. P. MARSH CORPORATION

2059 SOUTHPORT AVENUE, CHICAGO

O. D. GREENLEE.

To Mr. Tranter we extend our sincere wishes that the Kold-Hold Manufacturing Company may continue to forge ahead and enjoy the same measure of success that has attended the other enterprises coming under his management.

Later in the year Mr. Tranter announced the appointment of O. D. Greenlee as Sales Manager. Dan, as he is more familiarly known, has been with the above Company since the early part of 1933. Starting as a development and research engineer, his efforts soon were directed into the selling end of the business in the capacity of Sales Engineer. His thorough understanding and intelligent handling of the intricate refrigeration problems of the Company's patrons has won for him a host of friends, who will be glad to hear of his appointment as Sales Manager.

Immediately before coming to the Kold-Hold Manufacturing Company, Mr. Greenlee served in an important capacity in the Production and Engineering Test Department of the Crosley Radio Corporation.

At the annual stockholders' and Board of Directors' meetings of Kold-Hold Manufacturing Company, held on November 8th, James M. Degnan of Lansing, Michigan, was elected Vice-President of the Company and member of the Board.

Mr. Degnan is also Vice-President of the Hill-Diesel Engine Company and had previously been associated for a number of years with the Worthington Pump and Machinery Corporation, manufacturers of refrigerating and air conditioning machinery.

The Finest That Money Can Buy

BONNEY TOOLS

BONNEY
'CV' Chrome-Vanadium
Engineers' Wrench -
the original alloy steel wrench.

A Famous Wrench Backed by a Famous Guarantee

In July 1923, Bonney startled the tool world by announcing a new kind of wrench "guaranteed to strip the thread or break the bolt without damage to the wrench." It was the Bonney 'CV' Chrome-Vanadium Engineers' Wrench.

Today—14 years later—hundreds of other tools including a full line of tools for Refrigeration Service work are made of 'CV' Chrome-Vanadium Steel and carry the same guarantee as the original wrench.

Catalog No. 137 shows the full line of Bonney Tools. Write for your copy.

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

Stocked by leading jobbers everywhere.

I'm interested in refrigeration tools. Please send copy of No. 137 Catalog.

Name.....

St. & No.....

City & State.....

MAIL THIS COUPON TODAY →

INTERSTATE MACHINERY AND SUPPLY CONDUCTS SCHOOL

FOR their own sales force, and for the service engineers of the air conditioning and refrigeration concerns in Omaha and Council Bluffs, the Interstate Machinery and Supply Co., of Omaha, Nebr., held a school during the evenings of November 15, 16 and 17.

Participating in the program were: Mueller Brass Co., Peerless of America, Inc., Henry Valve Co., Automatic Products Co., Detroit Lubricator Co., and the Modern Equipment Co., who had representatives on hand to explain their products and give some interesting information to the meetings.

The attendance was good and the efforts put forth were well spent.

BORG WARNER TO HANDLE EXPORTS OF MUELLER BRASS CO.

THE Mueller Brass Company, of Port Huron, Michigan, has named the Borg Warner Service Parts Company, 310 South Michigan Avenue, Chicago, Ill., as export representative of its refrigeration products, Ray P. Johnson, manager of the Refrigerating & Heating Department of the Borg Warner Service Parts Company, has announced.

The Mueller line includes: valves, manifolds, flared fittings, streamline solder fittings, and copper tubing.

Borg Warner Service Parts Company also represents abroad the Henry Valve Company of Chicago, manufacturers of ammonia valves and fittings, driers and strainers, and the Electrimatic Corporation of Chicago, makers of automatic controls, regulators and safety devices.

MEETING OF STEWART WARNER DEALERS A SUCCESS

ORDERS for $3,000,000 worth of new 1938 refrigerators were booked by the Stewart-Warner Corporation during its national convention of refrigerator distributors, Nov. 11 and 12, it was today announced by J. E. Otis, Jr., president of the corporation. The volume of orders is approximately double that placed during the 1936 meeting, he said.

USE THE ZENITH REFRIGERANT FILTER

. . . FOR SULPHUR DIOXIDE, FREON OR METHYL CHLORIDE REFRIGERATORS

BECAUSE Zenith elements provide finer spacings (.002") than any asbestos sack or wire screen filter.

Easily installed—Easily cleaned
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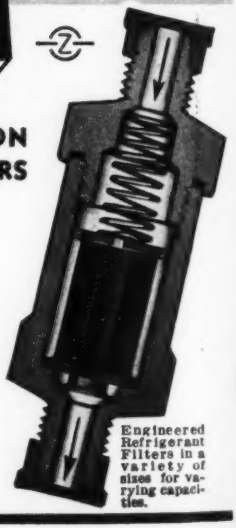
Ample Capacity

Positive protection against dirt in Expansion Valves, Solenoid Valves, Capillary Tubes and other liquid control devices.

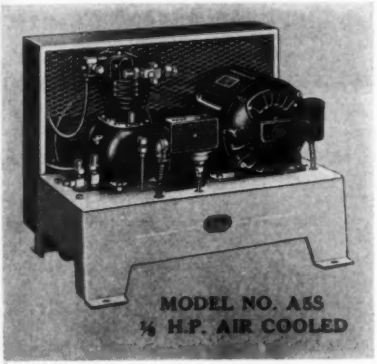
ZENITH CARBURETOR COMPANY
Subsidiary Bendix Aviation Corp.
DETROIT, MICHIGAN



Engineered Refrigerant Filters in a variety of sizes for varying capacities.

H. W. BLYTHE CO. TO HANDLE PAR CONDENSING UNITS

THE H. W. Blythe Co. has recently acquired the distributorship of the Par condensing unit in the Chicago area. These units are manufactured by the Modern Equipment Corp. of Defiance, Ohio, and according to Mr. Blythe, are available in sizes from ¼-hp. to 20-hp. at present, and in the near future, will also include a 15 and 20-hp. unit.



THE PAR UNIT

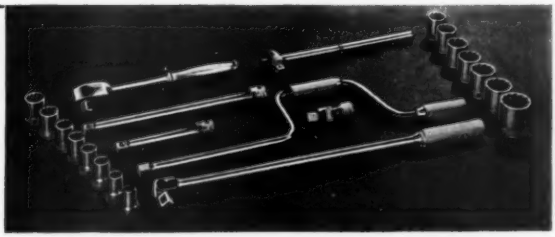
The ¼ to 1-hp. compressors are of the two-cylinder type, while the 1½ to 10-hp. compressors are of the four-cylinder V-type construction. All are designed for use with "Freon," but will operate successfully with methyl chloride.

Castings are all close-grained iron. Pistons are nickel-iron and are fitted with three piston rings. Crankshafts are drop-forged steel. Shaft bearings are Oilite. Connecting rods are made of bearing bronze. The valves and valve parts are made of stainless steel or other non-rusting materials. Wrist pins are steel hardened and ground. Cylinders and cylinder heads are effectively finned for efficient cooling. Shaft seal is hand lapped to insure perfect seat on shaft seal collar. External spring used on shaft seal to eliminate chatter and noise.

Equipment includes—grooved fan spoke flywheel, suction and discharge line valve. Bulls-eye sight oil gauge in crankcase.

Descriptive literature and price lists may be secured from the H. W. Blythe Co., 2334 S. Michigan Ave., Chicago, Ill.

BE READY FOR EVERY JOB . . .



• You can really "step on it" with these tools in your kit! They get you around on time. The Master Service Set, illustrated, offers you the best possible combination of matched units . . . 22 socket wrench units including every type of 1/2" drive handle plus a full range of 15 Straight-Wall Double Broached Hexagon Sockets, including sizes 7/16" to 1 1/4".

But this is only one of Snap-on's specialized tool sets for Refrigeration Service. See Snap-on Tools in the 1937 Master Catalog of Air Conditioning and Refrigeration or mail the coupon below.

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17 W. 60th Street, New York

STEWART-WARNER REFRIGERATOR PLANT WILL MOVE TO INDIANAPOLIS

THE Stewart-Warner Corp. has announced that negotiations for the purchase through a subsidiary of Plant No. 2 of the Marmon Motor Car Company at Indianapolis, Ind., were in an advanced stage.

By the purchase, Stewart-Warner acquires 22 acres of land, and buildings aggregating 539,000 square feet of floor space. The sale was made by the Liquidating Trustees of the Marmon Company.

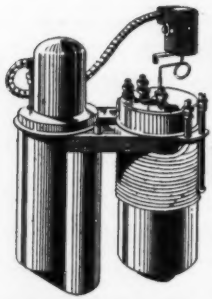
In announcing the negotiations, J. E. Otis, Jr., president of Stewart-Warner, said:

"It is our intention to transfer all refrigerator manufacturing operations from Chicago to our new plant in Indianapolis. Our Chicago plants have been running at a practical maximum capacity, and, to meet an increasing demand for our products and to carry out plans for new lines, we found that more space must be had, and in much less time than it would take to find a suitable site and build a factory. The Indianapolis plant is ideally suited to our manufacturing operations, is favorably located in relation to supplies of raw materials and to our markets, and was acquired at a price far below the cost of erecting similar buildings today.

"Buying the new plant," Mr. Otis continued, "is only one step in adjusting property holdings to the trends of the business. While we recently sold an unneeded office building in Detroit, we acquired the Indianapolis plant so that Stewart-Warner can continue its healthy growth."

Mr. Otis added that, while details of transferring the refrigerator manufacturing have not been worked out, most employes affected by the move will be offered employment in Indianapolis or will, as far as practicable, be given work in the Chicago plants.

Acquisition of the Indianapolis property brings to five the number of manufacturing plants of Stewart-Warner and subsidiary companies. The plants occupy a total of 50



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Easiest to sell. For beer, root beer, water, carbonated drinks, etc. Fits standard beer coil box. Perfect foam control. Accurate. Costs less to install and operate. Permits steam or chemically cleaning of beer coils. All refrigerants.

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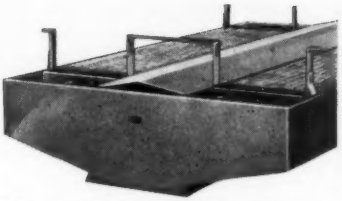
. . SEE YOUR JOBBER OR WRITE DIRECT . .

What is the absolutely correct placement of coils in a Walk-In Cooler for greatest cooling efficiency? Write for folder about the



AUTODRAFT Unit Cooler

Gives Facts that will Be Valuable to you.

For 43 years, makers of refrigeration and air conditioning coils.

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acres of land, and have an aggregate floor space of 2,200,000 square feet. More than 7,000 people are employed.

The principal products of the Stewart-Warner Corporation are: refrigerators; radios; Alemite lubricating devices and lubricants; automobile heaters, speedometers, gauges, and other instruments; furniture hardware and casters.

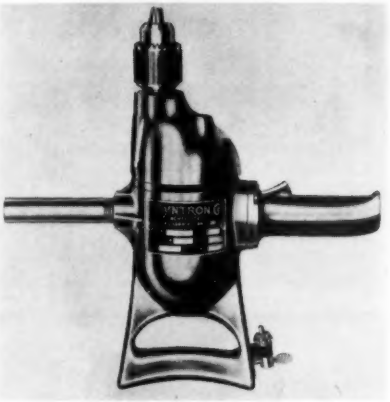
Of several products, it is the world's largest manufacturer. Distribution is world wide.

* * *

NEW ONE-HALF INCH PORTABLE ELECTRIC DRILL

SYNTRON COMPANY, Thomas Boulevard, Homer City, Pennsylvania, recognizing the ever-growing demand for modern labor-saving electric tool equipment, has brought out a complete new line of Portable Electric Drills, the leader of which in value is probably the ½ inch capacity Model No. 12-S illustrated.

This ½ inch capacity drill is of streamline design, with all corners rounded off so as not to catch in the operators' clothing.



SYNTRON PORTABLE ELECTRIC DRILL

Sturdy cross bar handles, together with an end spade handle, provide easy operation. The aluminum shell houses a powerful uni-

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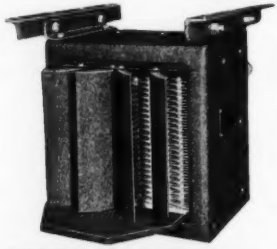

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Thermo Valves

• On repair and replacement jobs install Alco Thermo Valves. Their sturdy, simplified construction increases efficiency of the refrigeration unit and assures customer satisfaction. Their long life and trouble free operation will add to your own reputation.

ALCO VALVE CO., INC.
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St. Louis, Mo.

versal electric motor. The reduction gears are all of heat-treated chrome molybdenum steel, ball-bearing mounted. The 3-jaw geared Jacobs chuck accommodates up to ½ inch straight shank drill bits.

Popularly priced at $35.00, this drill is an ideal tool for all-purpose work on production lines, for factory maintenance and for outside rough construction service.

Catalog information on the entire line is available from the manufacturer.

\$ \$ \$

BOOK REVIEW

OIL BURNERS, by Kalman Steiner, chief engineer, Consumers Petroleum Co., Chicago, Ill. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 436 pages, illustrated. Price $4.50. For sale by NICKERSON & COLLINS Co., 435 N. Waller Ave., Chicago, Ill.

THIS new book, on the subject of oil burners, answers in 20 chapters, thousands of things you want to know about the servicing, installation and engineering of commercial and domestic oil burners. The book is well illustrated and is stated in such terms that the average person without a technical training will find it easily understandable.

Some of the subjects treated are as follows:

Principles of combustion as related to oil burning.
Comparative costs of coal, gas and oil.
Problems encountered in oil burner design.
How the various domestic burners work.
Comparisons and advantages of commercial oil burners.
Electric motors, fans, controls, ignition methods, fuel oil pumps.
Installation of industrial plants.
Service and maintenance methods.
Common troubles and their remedy.

A 38-page appendix in the back of the book contains useful tables used in the industry.

\$ \$ \$

D. D. WILE JOINS SAVAGE ARMS CORPORATION

RESIGNING from the post of Chief Engineer of the Refrigeration and Air Conditioning Division of Detroit Lubricator Company to join the Appliance Division of Savage Arms Corporation, Daniel D. Wile has been appointed Chief Engineer of the Refrigeration Department at the Utica, N.

Y., plant, according to an announcement issued by Savage. Mr. Wile has been associated with Detroit Lubricator Company since 1927, prior to which he was connected with the American Radiator Company in the research engineering and the accessories division laboratory. He is Vice-President of the Detroit Chapter of the American Society of Refrigerating Engineers and a member of the Detroit Refrigeration Code Committee. He is well known throughout the refrigeration industry as the author of numerous papers and articles dealing with refrigeration design and service. Mr. Wile is an alumnus of the College of Engineering of the University of Kentucky.

The Refrigeration Department of Savage Arms Corporation manufactures ice cream cabinets, delivery truck refrigeration and other commercial refrigeration products.

JOHNSON MOVES REFRIGERATION TO GALESBURG

A NEW large building, 250 feet by 115 feet, has just been completed by Johnson Motors on the outskirts of Galesburg, Ill., to provide necessary assembly and warehouse space for the rapidly growing activities of the Refrigeration Division of the company.

The new building program has also provided a new office building and adequate quarters for the engineering department, service, sales, production assembly and inspection. Thus much more needed space is provided in the main plant at Waukegan for the manufacture of Sea Horse outboard motors, as well as refrigeration compressors, evaporators, and other Johnson Products.

Mr. J. F. Furry, Chief Engineer in charge of engineering, development, and inspection is now located at the new address as well as C. A. Thomson, refrigeration sales manager and C. J. Geske, service manager, and H. L. Bourdon in charge of accounting and office management. The organization will be augmented with local personnel as needs require.

Johnson Motors entered the refrigeration industry some five years ago with the manufacture of mechanical units. About one year ago a complete line of electric household refrigerators bearing the name Briggs was introduced and its striking and immediate success has made the building expansion program necessary. The 1938 Briggs line is now in production and deliveries are being made from Galesburg.

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Oil burner practice from A to Z

Giving you a complete treatment of the design, production, installation, operation and maintenance of domestic, commercial and industrial oil burners.

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Oil Burners

436 pages, 213 illustrations, $4.50

This book takes up engineering, fundamental as well as advanced, and actual practical methods employed in oil burner practice. It treats of fuel oils, giving characteristics, specifications, combustion and handling. It describes all manner of applications: domestic, commercial and industrial, from bungalows to battleships.

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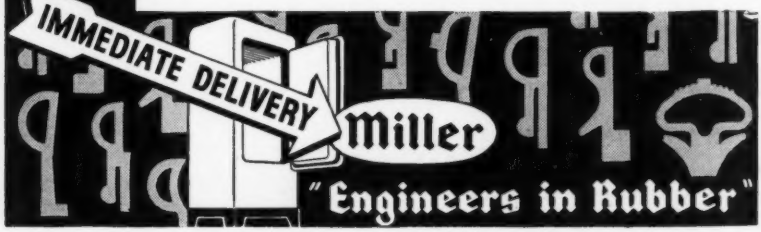
You have no product problems because Miller has already solved them. From their simplified line of 20 gasket types, you can service 80% of all refrigerators, regardless of make. Immediate delivery eliminates necessity for carrying large stocks.

Someone is going to get this profitable business. It might as well be you. Send for illustrated price list. If not available through your local jobber, write direct.

THE MILLER RUBBER COMPANY, INC., AKRON, OHIO



Want *Information*?

Use The R. S. E. SERVICE DEPARTMENT

—It's for Your Convenience

THIS department is conducted for the convenience of our subscribers. We will ask the manufacturers and distributors to send you the latest information on the items checked.

- ☐ Belts
- ☐ Blow Torches
- Blowers (see Unit Blowers)
- ☐ Books
- ☐ Brushes, Motor
- ☐ Bushings, Motor
- ☐ Carbon Tetrachloride
- ☐ Charging Hose
- ☐ Charging Stand

- Coils
  - ☐ Fin
  - ☐ Pipe
- ☐ Compressors
- Condensers
  - ☐ Air Cooled
  - ☐ Water Cooled
- ☐ Condenser Water Regulators
- ☐ Connecting Rods

- Controls
  - ☐ Cold
  - ☐ Humidity
  - ☐ Liquid Level
  - ☐ Pressure
  - ☐ Temperature
  - ☐ Thermostatic
  - ☐ Water
- ☐ Domestic Evaporators
- Dehydrants
  - ☐ Activated Alumina
  - ☐ Calcium Chloride
- ☐ Dehydrators
- Door Seals (see Gaskets)
- ☐ Drums, Service
- ☐ Dryers

- Evaporators
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- ☐ Float Valve Seats

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  - ☐ Flared
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  - ☐ Compressor
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- ☐ Hardware, Refrigerator
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- ☐ Lapping Compound and Materials
- ☐ Liquid Indicator
- ☐ Lubricating Oils
- ☐ Low Side Float Switches
- ☐ Low water
- ☐ Motors
- ☐ Needles, Float Valve
- ☐ Oil Return

- Packing
  - ☐ Fabric
  - ☐ Metallic
- ☐ Piston Pins
- ☐ Piston Rings
- ☐ Porcelain Refrigerator Cement
- ☐ Pumps, Circulating
- ☐ Receivers

- Recording Instruments
  - ☐ Humidity
  - ☐ Running Time
  - ☐ Temperature

- Refrigerants
  - ☐ Sulphur Dioxide
  - ☐ Methyl Chloride
  - ☐ Carrene
  - ☐ Freon
  - ☐ Iso Butane
  - ☐ Ethyl Chloride

- Refrigerator Dishes
  - ☐ Glass
  - ☐ Porcelain
- ☐ Safety Masks
- ☐ Seals, Shaft
- ☐ Resurfacing Stones

- Strainers
  - ☐ Expansion and Float Valve
  - ☐ Liquid Line
  - ☐ Suction Line

- Switches
  - ☐ Air Temperature
  - ☐ High Pressure Control
  - ☐ Low Pressure Control
  - ☐ Pressure
  - ☐ Temperature
- ☐ Mercury

- Thermostats
  - ☐ Air Temperature (Cooling)
  - ☐ Air Temperature (Heating)
  - ☐ Brine
  - ☐ Domestic Refrigeration
  - ☐ Industrial Refrigeration

- Thermometers
  - ☐ Refrigerator
  - ☐ Test
- ☐ Tool Chests

- Tools
  - ☐ Flaring
  - ☐ Pinchoff
  - ☐ Tube Bender
  - ☐ Tube Cutter
  - ☐ Wrench Sets
- ☐ Trap, Seals
- ☐ Trays, Ice Cube

- Tubing
  - ☐ Copper
  - ☐ Finned
  - ☐ Steel
  - ☐ Tinned
- ☐ Unit Blowers

- Valves
  - ☐ Automatic Expansion
  - ☐ By Pass
  - ☐ Check
  - ☐ Compressor
  - ☐ Expansion
  - ☐ Flapper
  - ☐ Magnetic
  - ☐ Pressure Reducing
  - ☐ Shutoff
  - ☐ Solenoid
  - ☐ Thermostatic Expansion
  - ☐ Two-Temperature
  - ☐ Water
- ☐ Valve Retainers
- ☐ Valve Stems

Write in Names of Products Not Listed

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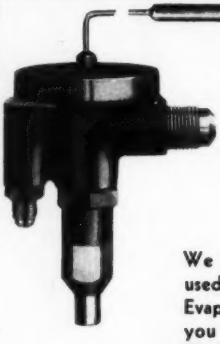
City and State .....

Business .....

Mail This Page to the

Refrigeration Service Engineer 433 N. Waller Ave., Chicago, Ill.



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from your two best friends

PEERLESS THERMAL
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MODEL 7

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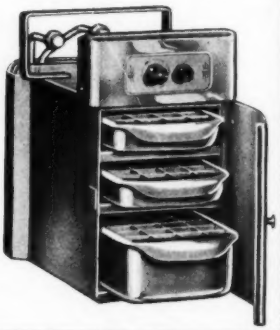
REPLACEMENT EVAPORATOR



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Jacksonville, Fla. — Jamis Company
Kansas City, Mo., Forslund Pump & Machinery Co.
Knoxville, Tenn. — Leinart Engineering Company
La Crosse, Wis. — W. A. Roosevelt Co.
London, Ont., Canada — Refrigeration Supplies Co., Ltd.
Long Beach, Calif. — L. B. Marsh
Los Angeles, Calif. — Refrigeration Service, Inc.
Los Angeles, Calif. — Refrigeration Parts Exchange
Louisville, Ky. — Louisville Mill Supply Co., Inc.
Lubbock, Texas — R. & R. Parts & Supply Co., Inc.
Macon, Ga. — Lowe Electric Co.
Madison, Wis. — Gustave A. Larson Co.
Memphis, Tenn. — United Refrigerator Supply Co.
Miami, Fla. — Bailey-Milam, Inc.
Milwaukee, Wis. — Chase Brass & Copper Co., Inc.
Milwaukee, Wis. — Refrigeration Specialty Co.
Minneapolis, Minn., Chase Brass & Copper Co., Inc.
Minneapolis, Minn. — Refrigeration & Industrial Supply Co., Inc.
Montreal, Quebec, Canada — Railway & Engineering Specialties, Ltd.
Newark, N. J. — T. W. Binder Co.
New Orleans, La. — Knorba Sales Co.
New Orleans, La. — The Spangler Co.
New York, N. Y. — Aetna Supply Co.
New York, N. Y. — Melchior, Armstrong, Dessau Co., Inc.
New York, N. Y. — Paramount Electrical Supply Co.
New York, N. Y. — The Harry Alter Co., Inc.
Norfolk, Va. — Noland Co., Inc.
Oakland, Calif. — Pacific Tool & Supply Co.
Oklahoma City, Okla. — Mideke Supply Co.
Omaha, Nebraska — United Supply Co.
Paterson, N. J. — White & Shaugry, Inc.
Peoria, Ill. — Wilkins Pipe & Supply Co.
Pittsburgh, Pa. — Williams & Co., Inc.
Philadelphia, Pa. — Melchior, Armstrong, Dessau Co., Inc.
Philadelphia, Pa. — Victor Sales Corporation
Portland, Ore. — Bill Hieber, 526 S. E. Wash.
Providence, R. I. — Rhode Island Supply & Eng. Co.
Roanoke, Va. — Noland Company, Inc.
Rochester, N. Y. — Ontario Metal Supply, Inc.
Rochester, N. Y. — Melchior, Armstrong, Dessau Co., Inc.
Rockford, Ill. — Gustave A. Larson Co.
Sacramento, Calif. — Hinshaw Supply Co.
Scranton, Pa. — Central Service Supply Co.
St. Joseph, Mo. — Bristol Supply Co.
St. Louis, Mo. — The Harry Alter Co., Inc.
St. Louis, Mo. — The Spangler Co.
Salt Lake City, Utah — Peerless Utah Co.
San Antonio, Texas — Straus-Frank Co.
San Francisco, Calif. — California Refrigerator Co.
San Juan, Puerto Rico — Refrigeration Supply Co.
Seattle, Wash. — Refrigerative Supply, Inc.
Sioux City, Iowa — National Refrigeration Service
South Bend, Ind. — The South Bend Supply Co.
South Bend, Ind. — F. H. Langsenkamp Co.
Springfield, Ill. — United States Electric Co.
Springfield, Mass. — C. P. Payson Co.
Syracuse, N. Y. — Syracuse Equipment Corporation
Toledo, Ohio — The Heat & Power Engineering Co.
Toronto, Ont., Canada — Railway & Engineering Specialties, Ltd.
Tulsa, Okla. — Machine Tool & Supply Co.
Vancouver, B. C., Canada — Fleck Bros., Ltd.
Washington, D. C. — Refrigeration Supply Co.
Waterloo, Iowa — Winterbottom Supply Co.
White Plains, N. Y. — County Seat Plumbing Supply Co., Inc.
Wilkes Borre, Pa. — Radio Service Co.
Winnipeg, Manitoba, Canada — Railway & Engineering Specialties, Ltd.
Worcester, Mass. — Standard Supply Co.

Factory Representatives

Chicago, Ill. — Los Angeles, Calif.
Dallas, Texas — New York, N. Y.
Dayton, Ohio — St. Louis, Mo.
Detroit, Mich. — San Francisco, Calif.

General Export Representatives

Melchior, Armstrong, Dessau Co., Inc.
300 Fourth Ave.
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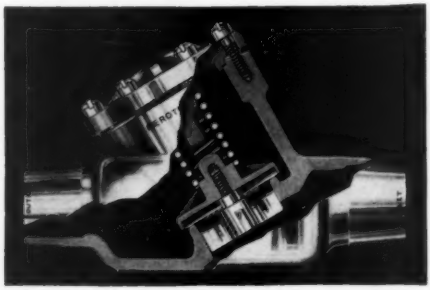

KEROTEST G-W Controls in the smaller sizes up to ¾" have made history in the development of modern refrigeration. Now comes the new EXTRA LARGE CAPACITY G-W Controls in a new range of sizes from ⅞" to 2⅛" O.D. to meet the widespread demand among air conditioning service engineers for a highly developed and extremely sensitive back pressure valve applicable to the largest installations. Note the easy accessibility for repairs through the bonnet cap, after long use.

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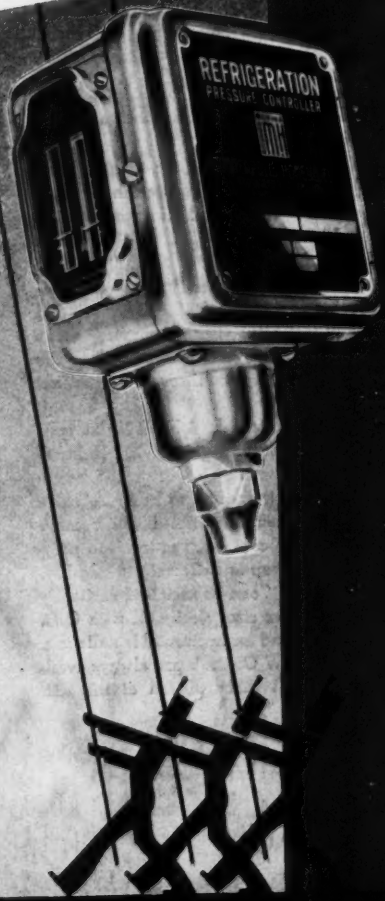

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